CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

AUGUST 15, 1943

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

HOW WE MEASURE COEFFICIENT OF EXPANSION

To determine the coefficient of thermal expansion of the ware to which our customers want to apply colors, a small glass rod is first cut from the product. The sample is measured accurately for length with a micrometer, inserted in a quartz tube, then placed in a special heater. Temperature readings and expansion meter measurements are taken every ten minutes for a period of six hours. From the data obtained, our technologists can determine the coefficient of expansion, the critical annealing temperature and the softening point. Other checks include polarizing microscope studies of ring sections which also help us formulate colors that "fit" the ware.

The Case of the Strained Relations

You have seen it happen many times: color, fused to ware showing up with a crazed finish, chipping away entirely—or worse. We welcome such problems in strained relations because it is our business to create harmony between basic glass and ceramic products and the colors used to decorate or label them. By compounding colors that "fit" the product, we solve the coefficient of expansion problem and save time, materials, and costly rejects.

For many years we have cooperated with our customers in the elimination of countless color difficulties, not only in "fitting" colors to particular methods and standards of manufacture but in making certain they have all the other qualities specifically required.

With so many materials changes occurring in these times, the experience, skill, and up-to-the-minute knowledge of Drakenfeld technologists can be of help to you in getting rid of production color bugs. Tell us your problem—confidentially, of course. Write today.

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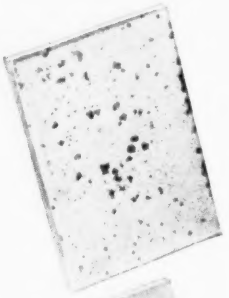
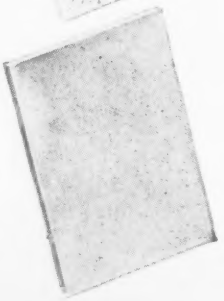


The crazed, chipped appearance of the surface of this sample shows how an improper color "fit" can ruin a product, waste materials and money.



When the color "fits" the product, the surface is smooth and unblemished. It is the job of Drakenfeld technologists to develop colors which "fit" your ware.

DRAKENFELD

YOUR PARTNER IN SOLVING COLOR PROBLEMS

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On the right-hand page, we list some advantages of "Lancaster" Mixers that apply to *all* forms of dry mixing, including steatite. Let us discuss them with you.

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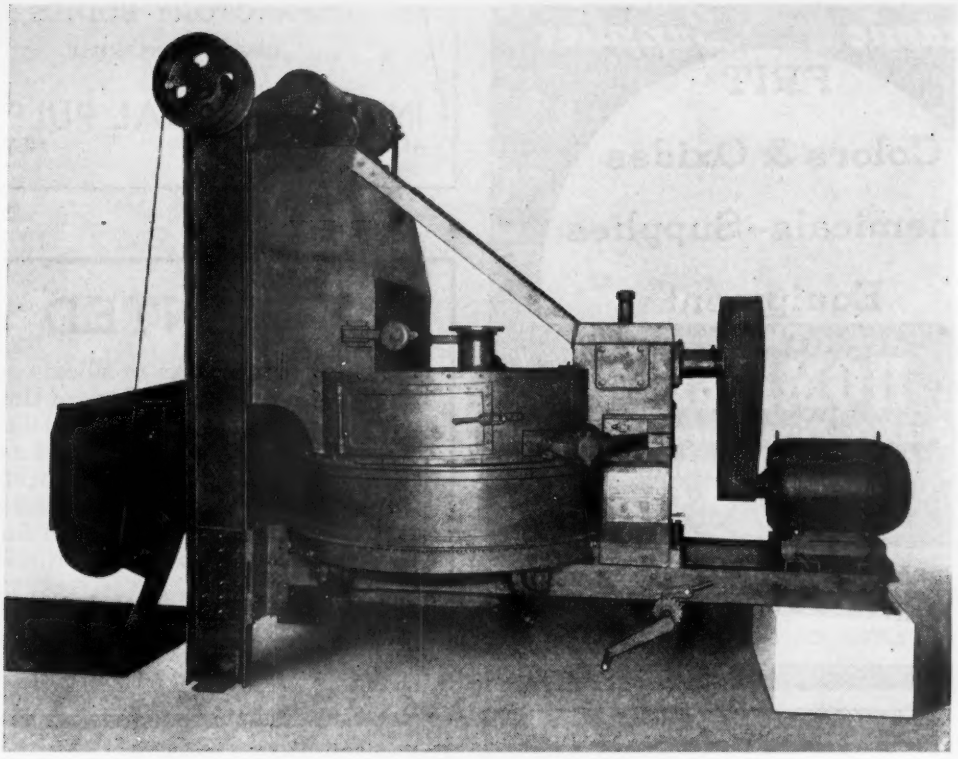

"Lancaster" Mixer, Symbol EAG-4 closed pan type, fitted with separately driven full batch elevator hopper.

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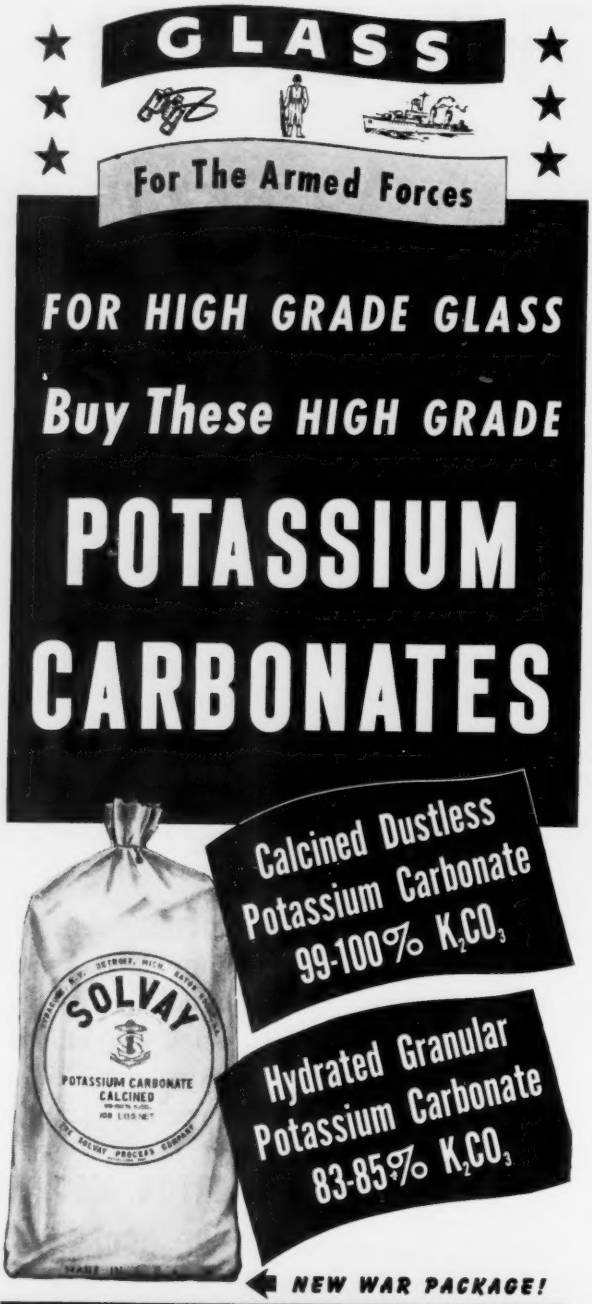

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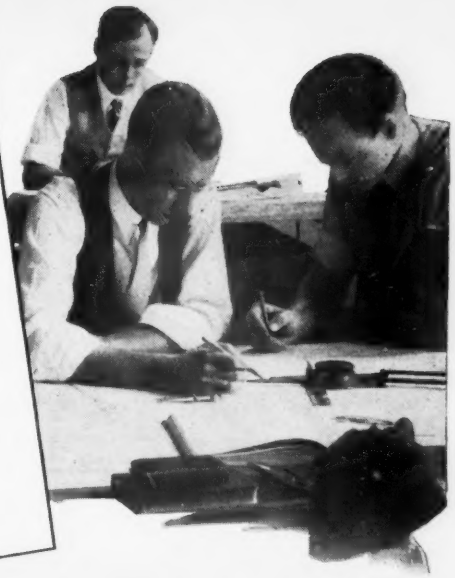

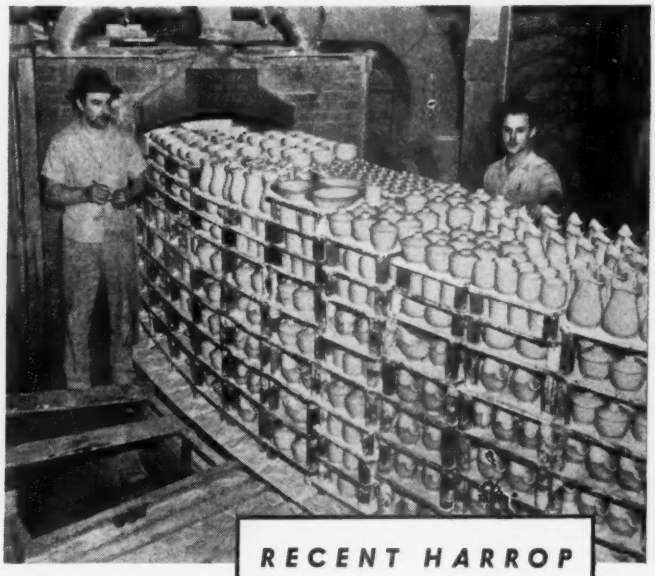

(Right) Harrop Circular Tunnel Kiln, Technical Porcelain and China Ware Corp., El Cerrito, Calif.; vitreous china ware. (Left) Harrop Tunnel Kiln; common brick.

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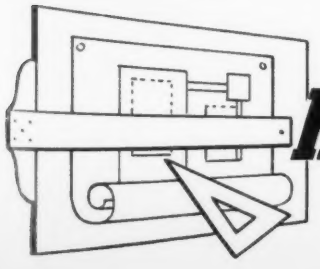

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October 1933 Journal

AMERICAN CERAMIC SOCIETY
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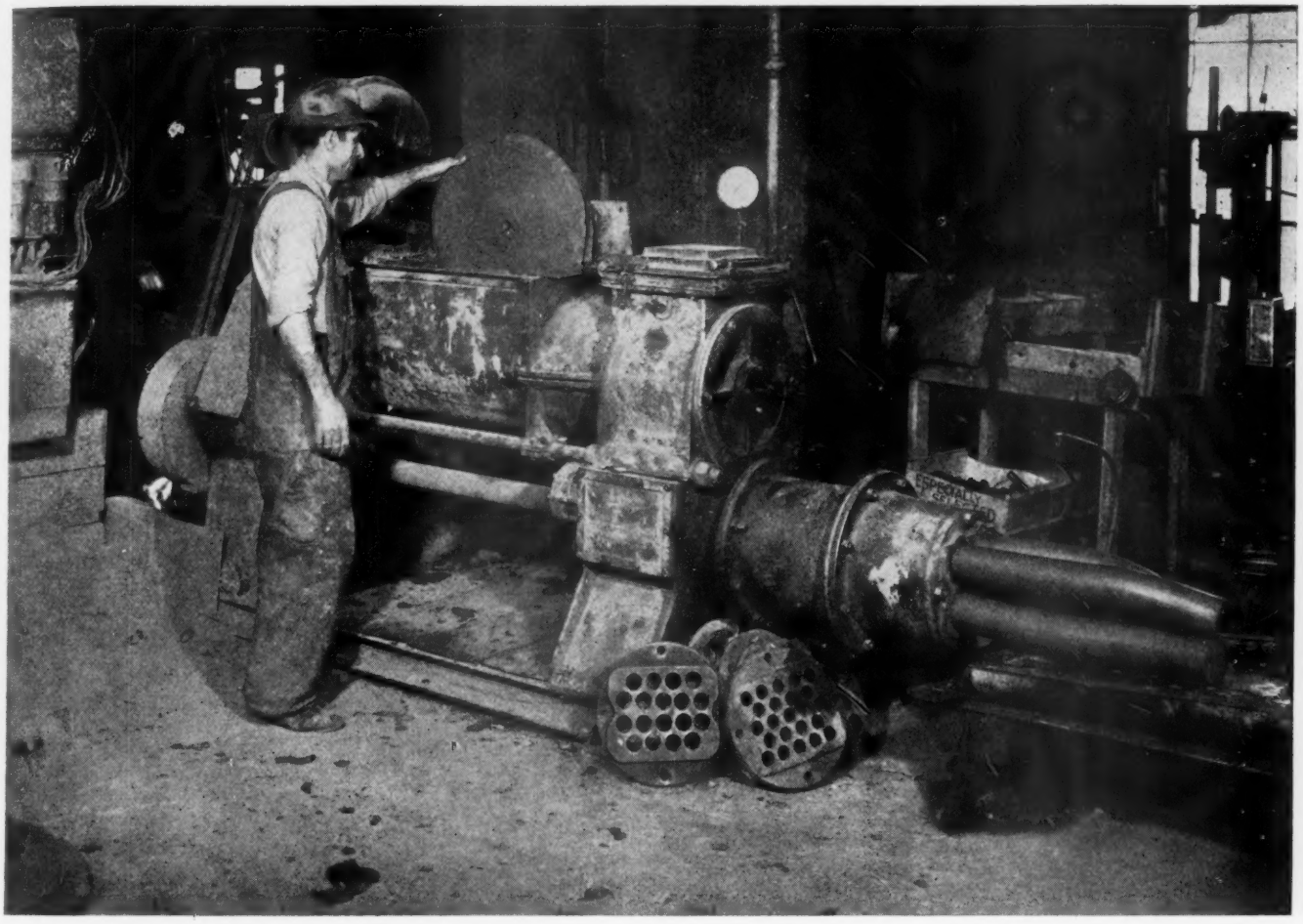
What's YOUR Percentage of Rejections?



THE Cleveland Pottery Company, Cleveland, Ohio, is extremely well satisfied with their F-R-H De-airing machine on every count. But one of the most important factors now is that rejects are kept to a minimum, quality is greatly improved. That's why they say, "We would find it difficult to return to the conventional type of machine."

On all types of ware, under all kinds of conditions, users of F-R-H clay working machinery consistently report a higher percentage of profitable production.

Take that into consideration when you plan for "tomorrow." In the meantime take the best possible care of your present equipment. Don't overload . . . check lubrication regularly . . . watch normal wearing parts. It will pay big dividends in the long run.

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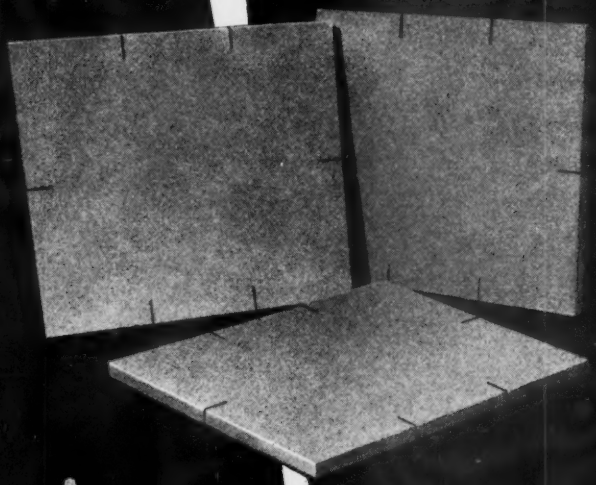

PLANTS producing steatite specialties for radio and communication systems are finding Norton *Crystolon* batts ideal. (Many are used in 12 to 24 hour cycles at around 2400°F.) The ruggedness of *Crystolon* (silicon carbide) allows plates of thin construction which pass heat quickly from source to ware. The slotts are a patented feature of *Crystolon* batts and prevent spalling. Physically durable and chemically stable at high temperatures, *Crystolon* batts assure long, uninterrupted service.

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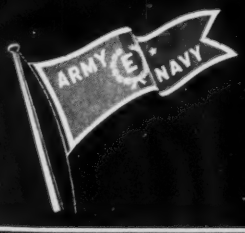

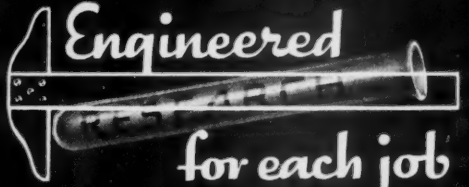

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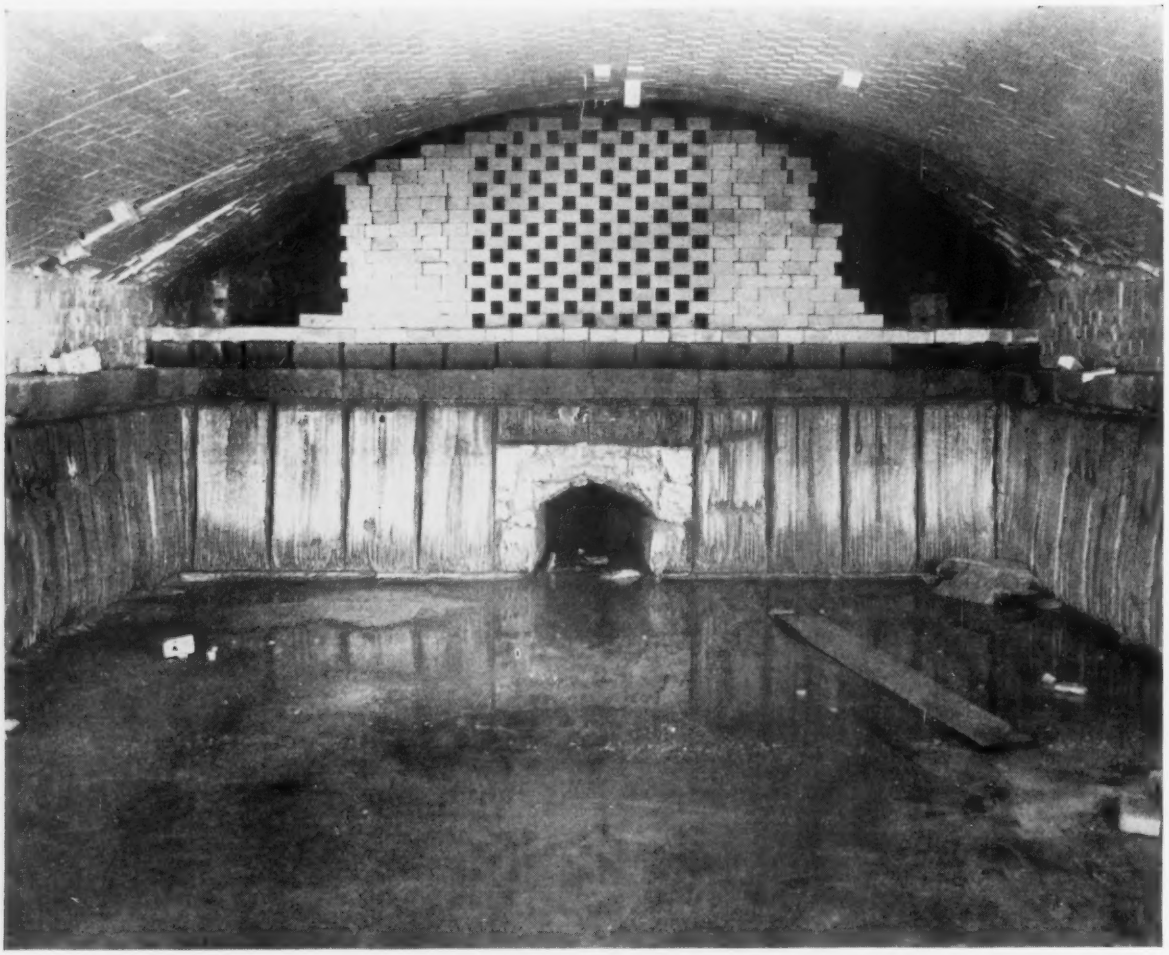

Floor-level Throat Runs Thirty-one Months!

FOR 31 months, the furnace above operated at high production on milk-bottle glass. It is obvious that in a campaign of this length, with a floor-level throat, no refractory could survive unless it were possessed of extraordinary quality and resistance.

The throat-cover blocks are Corhart* ZED Electrocast. As the photograph shows, the ZED throat not only survived, but apparently had considerable usefulness remaining at the end of the run.

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Ceramic Abstracts Section

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 22 **August 15, 1943** **No. 8**

Abrasives

Avoiding specific blemishes when grinding ultrafinish rolls. H. J. WILLS. *Steel*, **109**, 92–96 (Aug. 11, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **144** [2] 201A (1941).—W. describes and illustrates the effects produced on the roll surface by the chattering of some part of the grinding machine, building vibration, incorrect alignment of the wheel and work, a dirty cooling medium, and other causes, and shows how these faults can be eliminated.

Billet grinding. A. O. ROUSSEAU. *Iron Age*, **145**, 45–47 (June 20, 1940); abstracted in *Jour. Iron & Steel Inst.* [London], **142** [2] 188A (1940).—R. discusses the factors affecting the efficiency and economy of grinding in the dressing of high-chromium and chromium-nickel steel billets. He deals in particular with the effects of increasing the speed of the grinding wheel and the pressure with which it is applied to the surface. His general conclusions are as follows: (1) The rates of grinding and of wheel wear are proportional to the surface speed of the wheel. (2) The wheel wear per unit of work ground remains constant regardless of wheel speed. (3) Increasing the pressure increases both the rate of cut and the rate of wheel wear.

Countersink-grinding fixture. ANON. *Machinery* [N. Y.], **49** [7] 178 (1943).—The countersink-grinding fixture developed by the Industrial Grinding Co., Los Angeles, Calif., is described. R.H.B.

Dia-Tool metal-bonded diamond wheels. ANON. *Machinery* [N. Y.], **49** [7] 194 (1943).—A line of metal-bonded diamond cup wheels designed for offhand grinding and lapping of cemented carbide and for grinding and edging quartz and glass has been introduced by Dia-Tool, Inc., Yonkers, N. Y. R.H.B.

Factors that influence grinding rolls for ultrafinish work. H. J. WILLS. *Steel*, **109**, 56–60 (July 21, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **144** [2] 201A (1941).—W. makes recommendations on the technique of grinding rolls for producing rolled products with a high-quality surface finish. The selection of a grinding wheel with the right grit and bond and the correct relation between the grinding-wheel speed and the roll speed are most important. For ultrafinish, the roll speed should be as high as possible without causing vibration. In making the finishing pass, the ratio of the traverse to the roll speed should be as low as possible, with not more than 0.25-in. traverse per revolution of the roll, and the grinding wheel should not be allowed to move more than a quarter of its width off the roll at the end of its traverse.

Improved angle-set tool for diamond dressers. ANON. *Machinery* [N. Y.], **49** [7] 196 (1943).—A new 30° angle-set attachment for dressing wheels for the centerless grinding of bullet noses has been made by the Diamond Tool Co., Chicago, Ill. R.H.B.

Story of abrasives. S. F. WALTON. *Monthly Rev. Amer. Electroplaters' Soc.*, **27**, 841–51 (1940); *Chem. Abs.*, **35**, 2290 (1941).—W. deals with the manufacture and grading of abrasives and the standardization of sieve sizes.

Supply of bauxite in the Western Hemisphere. H. BAUM. *Metallwirtschaft*, **20** [33] 818–20 (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 149, p. 319 (1941).—B. discusses the U. S. bauxite industry, dependence of the U. S. Al industry on imported bauxite, and sources of supply (British and Dutch Guiana, Brazil, Netherlands East Indies, Gold Coast). The Alcoa Steamship Co. is said to use 36 ships for bauxite transport.

Wheel-dressing compound for wet grinding. ANON. *Machinery* [N. Y.], **49** [7] 173 (1943).—Ever-Drest is a compound which may be added to the grinding-wheel water to reduce the surface tension of the water and keep the pores of the wheel open. Wolfe-Kote Co., Sheboygan, Wis., manufactures the material. R.H.B.

PATENTS

Abrasive. M. N. KOSHURNIKOV. Russ. 57,002, April 30, 1940. 80*b*. 11.—An abrasive is produced by heat-treating pyrophyllite. This is accomplished by heating a clean pyrophyllite, containing no corundum, to 1400°. M.Ho.

Abrasive article. G. VAN NIMWEGEN (Carborundum Co.). Can. 412,738, May 25, 1943 (May 12, 1941). Can. 412,739, May 25, 1943 (July 16, 1942; in U. S. Sept. 6, 1941). G.M.H.

Abrasive material. H. N. BAUMANN, JR., AND R. C. BENNER (Carborundum Co.). Can. 412,901, June 1, 1943 (Jan. 4, 1941; in U. S. Jan. 8, 1940). G.M.H.

Abrasive product. N. P. ROBIE (Carborundum Co.). U. S. 2,321,422, June 8, 1943 (Aug. 17, 1940).—A coated abrasive article consisting of a backing and a surface layer of abrasive grains attached thereto.

Bonded abrasive body. W. H. BATEMAN (A. C. Wickman, Ltd.). Can. 412,646, May 18, 1943 (Jan. 22, 1942). G.M.H.

Cam-grinding machine. H. E. BALSIGER (Landis Tool Co.). U. S. 2,323,189, June 29, 1943 (Dec. 23, 1941).

Cam-lapping machine. H. S. INDGE AND J. C. BAKER (Norton Co.). Can. 412,946, June 1, 1943 (Feb. 26, 1942; in U. S. April 1, 1941). G.M.H.

Centerless grinding machine. C. G. EKHOLM. U. S. 2,322,619 and 2,322,620, June 22, 1943 (Oct. 10, 1940).

Coated abrasive. N. E. OGLESBY (Behr-Manning Corp.). U. S. 2,322,156, June 15, 1943 (Dec. 30, 1941).

Contour forming apparatus. W. C. HARPER (American Optical Co.). U. S. 2,321,383, June 8, 1943 (Sept. 28, 1940).

Crankshaft grinding machine. R. A. COLE AND F. E. JOHNSON (Norton Co.). U. S. 2,322,727, June 22, 1943 (July 15, 1941).

Diamond abrasive articles. A. ABBEY (Carborundum Co.). Brit. 552,848, May 12, 1943 (Oct. 22, 1941).

Duplex lapping machine. H. S. INDGE (Norton Co.). Can. 412,945, June 1, 1943 (Feb. 25, 1942; in U. S. May 29, 1941). G.M.H.

Finishing and polishing equipment. C. J. LIPPOLD (J. M. Nash Co.). U. S. 2,322,459, June 22, 1943 (Aug. 12, 1940).

Fluid-actuated head for abrading elements. H. M. WHITTAKER (Micromatic Hone Corp.). U. S. 2,323,433, July 6, 1943 (Aug. 13, 1937).

Gear grinding wheel dresser and gear form checker. S. J. KOPEC. U. S. 2,321,825, June 15, 1943 (Aug. 23, 1941).

Grinding and/or lapping machine. P. G. THOMAS. U. S. 2,322,896, June 29, 1943 (May 13, 1942).

Grinding machine. C. G. FLYGARE AND S. S. MADER (Norton Co.). Can. 412,944, June 1, 1943 (Feb. 25, 1942; in U. S. May 29, 1941). W. H. WOOD (Norton Co.). Can. 412,943, June 1, 1943 (July 29, 1941; in U. S. Oct. 26, 1940). G.M.H.

Grinding wheel truing apparatus. L. A. KASPARSON (Norton Co.). Can. 412,619, May 18, 1943 (July 6, 1942; in U. S. Oct. 21, 1941). L. A. KASPARSON AND J. I. GARSIDE (Norton Co.). Can. 412,947, June 1, 1943 (June 9, 1942; in U. S. July 23, 1941). G.M.H.

Honing machine. H. J. CALDWELL (Barnes Drill Co.). U. S. 2,322,346, June 22, 1943 (April 3, 1941). J. E. KLINE (Micromatic Hone Corp.). U. S. 2,323,780, July 6, 1943 (Nov. 27, 1939).

Lapping machine. H. S. INDGE (Norton Co.). Can. 412,940, June 1, 1943 (July 23, 1941; in U. S. Oct. 5, 1940). Can. 412,941, June 1, 1943 (Aug. 13, 1941; in U. S. June 1, 1940). G.M.H.

Method and machine for truing grinding wheels. G. F. JOHNSON (Bower Roller Bearing Co.). U. S. 2,323,401, July 6, 1943 (Dec. 23, 1940; Sept. 15, 1941).

Normal dresser for grinding wheels. FELLOWES GEAR SHAPER CO. Brit. 553,130, May 19, 1943 (May 22, 1941).

Polishing machine. T. F. PHILIPPI. U. S. 2,322,589, June 22, 1943 (April 29, 1940).

Preparation of lapping, polishing, grinding, etc., surfaces. COVENTRY GAUGE & TOOL CO., LTD., H. H. HARLEY, AND J. E. WAINWRIGHT. Brit. 552,836, May 12, 1943 (April 3, 1942).

Production of grinding tools and wheels. ANGLARDIA, LTD., AND W. A. DAWES. Brit. 553,226, May 26, 1943 (May 16, 1942).

Shaft grinder. W. C. HANRAHAN. U. S. 2,321,081, June 8, 1943 (Nov. 10, 1941).

Sheet abrasive. R. W. HACKETT (Abrasive Products, Inc.). U. S. 2,321,744, June 15, 1943 (Sept. 22, 1941).

Surface-grinding machine. H. A. SILVEN (Norton Co.). Can. 412,942, June 1, 1943 (July 28, 1941; in U. S. Oct. 18, 1940). G.M.H.

Titanium carbide manufacture. R. R. RIDGWAY (Norton Co.). Can. 412,618, May 18, 1943 (Oct. 17, 1940). G.M.H.

Tools for dressing the operative surfaces of grinding wheels and for other purposes. E. L. MEESON AND J. I. MEESON. Brit. 553,151, May 19, 1943 (June 26, 1942).

Art and Archeology

Designs for stained glass at Poundisford Park, Taunton, attributed to Aert Claesz, 1498–1562. A. E. POPHAM. *Jour. Brit. Soc. Master Glass Painters*, **8**, 101–104 (1940–1941); abstracted in *Jour. Soc. Glass Tech.*, **25** [108] 161 (1941).—The designs are briefly described and illustrated, and reasons are given for attributing the work to Claesz.

Formation of cracks in ceramic glazes. EROS BIAVATI. *Ceramica*, **4**, 33 (1942); abstracted in *Chem. Zentr.*, **1942, II** [2] 210.—The appearance of cracks is conditioned by the difference in the thermal-expansion coefficients of the body and the glaze and may occur after a long period of time if the porous body gradually absorbs water from the air and expands. M.V.C.

Medieval glass in Holme-by-Newark Church, Notts.: IV. N. TRUMAN. *Jour. Brit. Soc. Master Glass Painters*, **8**, 105–108 (1940–1941); abstracted in *Jour. Soc. Glass Tech.*, **25** [108] 161 (1941).—T. gives an account of the completion of the repair of this church, which now contains glass of every century from the 13th to the 17th. 3 illustrations. See *Ceram. Abs.*, **17** [7] 248 (1938).

Medieval pictorial art. F. HARRISON. *Jour. Brit. Soc. Master Glass Painters*, **8**, 89–95 (1940–1941); abstracted in *Jour. Soc. Glass Tech.*, **25** [108] 161 (1941).—The art of coloring glass was one of three kindred arts practiced during the eight centuries between the early days of Christianity in Britain and the Reformation. By the end of the 13th century, every church was well stocked with colored glass, wall paintings, and service books (illuminated or not). No church was regarded as complete until most of its window spaces were filled with colored glass.

Old glasshouses of the Oberlausitz. K. GLOWNA. *Glashütte*, **69** [30] 513–14 (1939).—Old records and documentary evidence of the owners and families who operated the glassworks in the region of Prussian Oberlausitz during the Middle Ages are referred to. M.V.C.

Postwar home appliances challenge designer and manufacturer alike. ANON. *Ceram. Ind.*, **40** [6] 45–47 (1943).—A view of kitchen units and laundry equipment of the future, as described in present-day women's magazines, is given. It is pointed out that not all ideas may be practicable, but some are worth watching for peacetime manufacture. Illustrated. H.T.

Preliminary study of the pottery of the Bantu tribes of the Union of South Africa. J. F. SCHOFIELD. *S. African Jour. Sci.*, **39**, 256–81 (1942).—Manufacturing methods of different tribes vary from direct hand molding of lumps of clay to building up the walls of the pot from rings of wet clay. The base is added last by the Tswana. A small grass mat is generally used as a stand, but the Venda use a potsherd and rotate it with one hand while the clay is worked with the other. The Venda also use horn scrapers, while the other tribes use the fingers only. Decoration may consist in sticking on pellets of clay (usually in some sort of pattern) while the pot is still green, making incisions with the fingernail or a simple tool, applying a wash of color (ocher), or molding (rare). After air-drying, the ware is fired by piling fuel over it, either in the open or in a hole in the ground, and igniting. No attempt is made to build a kiln. All potting is done by the women. The industry is dying out. Illustrated. L.W.V.

Remolding of Art Division into Design Institute (discussion). *Bull. Amer. Ceram. Soc.*, **22** [7] 244–48 (1943).

PATENT

Visual color comparator. E. M. ZELONY. U. S. 2,321,722, June 15, 1943 (Oct. 4, 1940).

Cements

Function of carbon dioxide in producing efflorescence on plaster and cement products. DANA L. BISHOP. *Jour. Research Nat. Bur. Standards*, **30** [5] 361–66 (1943); RP 1538. Price 5¢.—Hydrated magnesium sulfate was identified as the principal constituent of efflorescence on plaster. Its formation is accounted for by reactions involving magnesia and gypsum in the plaster, CO_2 from the air, and moisture. This type of efflorescence was also observed on some cement products. R.A.H.

Hydration of the aluminates of calcium. G. M. HARRIS, W. G. SCHNEIDER, AND T. THORVALDSON. *Can. Jour. Research*, **21** [4] 65–72 (1943).—A study was made of the hydrothermal reactions of tricalcium aluminate and its hydrates between 120° and 350°C. Homogeneous samples of the hexahydrate of tricalcium aluminate may be prepared by treatment of the aluminate or its hexagonal hydrate in saturated steam at temperatures up to 150°C. At temperatures of 250°C. and above, under conditions favoring rapid hydrolysis, such as the addition of water to the anhydrous aluminate or hydroaluminate before autoclaving and rapid elevation of the autoclave, crystals of calcium hydroxide and of a hydroaluminate of lower lime-alumina ratio appear, usually mixed with the isometric hexahydrate. The new hydroaluminate occurs as rectangular, elongated, prismatic plates of low birefringence, with a refractive index of 1.627, and has a lime-alumina ratio probably lower than 1.5. The hexagonal hydrate of tricalcium aluminate gives, on hydrothermal treatment, a better yield of the low-limed hydroaluminate. Only partial hydrolysis of the hexahydrate was obtained under any of the conditions used, but the hexagonal hydrate, autoclaved for 12 hr. at 350°C., gave products composed almost entirely of the rectangular-plate hydroaluminate and calcium hydroxide. No free hydrated alumina was found in the hydrothermal products. Precast Portland cement concrete products, when subjected to steam curing, normally contain an excess of water, and the conditions for the formation of these birefringent hydroaluminates of calcium are therefore present. The same applies to the commercial steam-curing of other materials containing free lime and hydrated alumina. The formation of these hydroaluminates may explain the peculiar effect on the tensile and compressive strengths of mortar and concrete test pieces produced by hydrothermal treatment at temperatures above 150°C. G.A.K.

Study of the system CaO–Al_2O_3–H_2O at temperatures of 21° and 90°C. LANSING S. WELLS, W. F. CLARKE, AND H. F. MCMURDIE. *Jour. Research Nat. Bur. Standards*, **30** [5] 367–409 (1943); RP 1539. Price 10¢.—Diagrams have been constructed showing the solubility relations of the various phases of the system CaO–Al_2O_3–H_2O at 21° and 90°C. The solid phases were investigated by petrographical and X-ray diffraction methods. By means of X-ray diffraction patterns, it was found that the so-called hexagonal tricalcium aluminate hydrate is in reality a mixture of hexagonal $2CaO{\cdot}Al_2O_3{\cdot}8H_2O$ and hexagonal $4CaO{\cdot}Al_2O_3{\cdot}13H_2O$ intercrystallized in equimolecular proportions. On standing at room temperature, dry dicalcium aluminate hydrate is slowly converted into the tetracalcium aluminate hydrate and hydrated alumina. Loss of water of hydration in the tetracalcium aluminate hydrate results in a decrease in the unit cell along the c axis. Although the hexagonal dicalcium and tetracalcium aluminate hydrates exist only as metastable phases in the system between 21° and 90°C., their approximate solubility relationships were ascertained at 21°C. As the temperature increases, the hexagonal aluminates become less stable. The only stable phases that occur in the system CaO–Al_2O_3–H_2O at atmospheric pressure over the temperature range 21° to 90°C. are gibbsite, the isometric tricalcium aluminate hexahydrate, and $Ca(OH)_2$. The solubility curves of these three stable phases in the system CaO–Al_2O_3–H_2O were determined at 21° and 90°C. R.A.H.

PATENTS

Anhydrous cement. P. P. BUDNIKOV AND K. F. MUKHIN. Russ. 56,832, April 30, 1940. 80*b*. 3.09.—Gypsum calcined at 600° to 700°C. is ground together with a kaolin, clay, or similar material. The kaolin, etc., is previously calcined at a temperature at which its nucleus decomposes, then washed with H_2SO_4, and dried. M.Ho.

Cement manufacture. MIKAEL VOGEL-JORGENSEN (F. L. Smith & Co.). Can. 413,107, June 8, 1943 (May 13, 1941). G.M.H.

Magnesium cement article and method of making. ERNEST SANDS. U. S. 2,321,522, June 8, 1943 (June 5, 1939).—The process for producing articles from magnesium oxychloride cements which comprises forming a paste comprising water, a wax magnesium oxide, and magnesium chloride, pouring the paste into a suitable mold, allowing the material to solidify until it can be removed in one piece from the mold, and forming the material into the desired shape by the application of sufficient pressure.

Enamel

Boron-free frit grounds for enameling cast iron. H. LANG. *Keram. Rundschau*, **48** [45] 376–77 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 424.—According to the melting-temperature curve for soda quartz, the borax in the frit ground can be replaced by soda. Even small additions of fluorspar raise the impact strength of boron-free frit grounds considerably. Enamelers' powdered glass can be used as a borax substitute. The preparation of this type of boron-free frit ground is described. M.V.C.

Boron-free grounds for cast-iron enameling. H. LANG. *Keram. Rundschau*, **48** [48] 401–403 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 684.—When a borax substitute is used, the soda content must not exceed 10 to 12%. A mixture of soda and fluorspar to which some $BaCO_3$ has been added has proved satisfactory. A boron-free batch is given: 14 quartz, 30 feldspar, 26 powdered glass, 10 soda, 15 fluorspar, 5 barium carbonate; additions to the mill are unchanged. M.V.C.

Cerium oxide as white opacifier for enamels. A. KRAFT. *Keram. Rundschau*, **50,** 113–15 (1942); abstracted in *Chem. Zentr.*, **1942, II** [4] 446.—The development of the use of cerium oxide as a white opacifier in place of tin oxide in enamels with and without boron is described. Cerium oxide is used only as a mill addition. The practical applications of cerium oxide in the manufacture of different enamels are discussed. M.V.C.

Core and mold coatings, their use and action in foundry production. J. A. RIDDERHOF. *Can. Metals & Met. Inds.*, **5** [11] 327–31 (1942).—R. reviews the present knowledge and understanding of core and mold coatings, summarizing the purposes of the various materials used in core washes and blackings, the uses of carrier liquids, methods of applying and drying core washes, and the types of coatings best suited for specific applications. E.C.P.

Determination of acid resistance and decreased display value of enamels undergoing loss of gloss. L. STUCKERT. *Sprechsaal*, **73,** 117 (1940); *Chem. Abs.*, **34,** 6784 (1940).

Enamel coating on piston reduces engine knock. ANON. *Science News Letter*, **43** [16] 248 (1943).—Glassy enamel containing cobalt and alumina on the face of a gasoline-engine piston and on the inner surface of the cylinder head reduces knocking and minimizes the formation of carbon on the piston head. G.A.K.

Formation of blisters, pinholes, and black specks on vitreous enameled cast iron. A. L. NORBURY. *Foundry Trade Jour.*, **64,** 161–62, 164 (1941); *Chem. Abs.*, **35,** 4170 (1941).—Between the enamel surface and the cast iron, a layer of discolored enamel forms owing to surface reaction. The layer is brought to the surface by gas bubbles and forms blisters when still covered with some

enamel, pinholes when the bubbles break through, and black specks when, after the break, the bubbling stops and a fusion of the discolored enamel results. The bubbles are caused either by entrapped gases when the casting was chilled or by gases from reactions. The oxides of the enamel react with graphite and combined C. As there is practically no diffusion of graphite, small graphite grains are not dangerous. Oxidized defects on the metal surface and subsurface can react with C and cause bubbles. Sand grains can also cause defects.

Glass technology as applied to the study of vitreous enamels. R. J. SLAWSON. *Foundry Trade Jour.*, **63,** 12–13, 79–81 (1940); *Chem. Abs.*, **34,** 8193 (1940).—S. reviews the nature and constitution of glass, its physical properties (especially thermal expansion and viscosity) and chemical composition, classification according to the acidic radicals present, effect of various constituents, color, opacity, melting processes, and testing methods.

How one enamel plant adjusted production to war times. ANON. *Ceram. Ind.*, **40** [6] 42–44 (1943).—The Century Vitreous Enamel Co., Chicago, Ill., converted some of its frit and enamel furnaces to the heat-treating and annealing of metal parts. Enameling and frit making is carried on to a limited extent. Illustrated. H.T.

Luminous paint and luminous enamels. P. EYER. *Emailwaren-Ind.*, **19,** 7–8 (1942); abstracted in *Chem. Zentr.*, **1942, II** [4] 446.—E. discusses Swiss Pat. 166,802, in which zinc sulfide is used as a luminous substance, and gives instructions for suitable parent batches. The luminous enamel made in this way may be exposed to all kinds of atmospheric agents without losing the properties of phosphorescence and luminosity. M.V.C.

Practical method using gas opacification in heavy industry for cover enamels with and without borax and the recovery of iron by de-enameling. H. VYSTAVEL. *Emailwaren-Ind.*, **18,** 109–11, 115–17 (1941); abstracted in *Chem. Zentr.*, **1942, II** [2] 210.—In gas opacification, fixatives should not be used. The slip should be kept as thick as possible. A de-enameling process is described in which molten caustic soda is used. Boron-free enamels must be ground very fine. M.V.C.

Zircon for foundry use. GEORGE F. COMSTOCK. *Metal Progress*, **38** [6] 807 (1940).—Zircon used as a facing or wash over regular foundry sand possesses considerable merit because of its refractoriness; it does not soften when extremely hot metal is poured, and castings having good surfaces are easily obtained. B.C.R.

PATENTS

Enamel coating for ferrous metals. A. E. CHESTER (Poor & Co.). U. S. 2,321,656, June 15, 1943 (June 19, 1941). U. S. 2,321,657, June 15, 1943 (June 23, 1941).

Glass-lined hot-water tank. O. E. UECKER (A. O. Smith Corp.). U. S. 2,322,488, June 22, 1943 (May 6, 1940).

Porcelain enamel ground coat. G. H. MCINTYRE AND E. E. BRYANT (Ferro Enamel Corp.). U. S. 2,321,763, June 15, 1943 (May 9, 1939).—In the art of porcelain enameling, the process of providing a coat of porcelain enamel applied directly to a ferrous surface which comprises providing a plurality of porcelain enamel frits of compositions suitable for direct application to the work and differing in the limits of their respective fusion ranges by temperatures of 25° to 100°F., preparing a slip comprising a mixture of about 1–4 to about 4–1 parts of the different frits, the frit of the relatively high fusing range reduced to a fineness such that about 85 to 95% will pass through a 325-mesh screen and the frit of the relatively lower fusion range reduced to a fineness such that about 85 to 98% will pass through a 200-mesh screen, and about 5 to 50%, based on the total amount of frit, of a material selected from the class consisting of silica, quartz, and feldspar and of a particle size substantially larger than colloidal but generally smaller than that of the frit, applying such slip to the work, and firing it at a temperature between the limits of the fusion ranges of the frits.

Process for use in coating metal surfaces. A. E. CHESTER (Poor & Co.). U. S. 2,321,658, June 15, 1943 (June 27, 1941).—A process of preparing a bonding compound for use in the enamel-coating processes which consists in first preparing a basic mixture composed of antimony oxychloride, silica gel, and an alkaline arsenate salt, then dry mixing the basic mixture and subsequently combining it in an aqueous colloid with stannous chloride and bentonite to complete the composition, and finally grinding the complete composition to a fineness for use as a spray.

Glass

Centrifuge technique in research of glass cords. L. G. GHERING. *Ceram. Ind.*, **40** [6] 58–59 (1943).—By means of the new centrifuge technique it is possible to measure differences in densities of glass powders as low as 0.00002. The cord powder can be separated from the matrix powder. See *Jour. Amer. Ceram. Soc.*, **24** [8] 264–70 (1941). H.T.

***Colorimetric value of certain signal glasses for railroads.** J. GENARD. *Rev. Universelle Mines*, **18** [1] 12–16 (1942).—The determination of color values as represented in the color triangle is described, and several colored glasses of Belgian glass plants are analyzed with regard to transmission efficiency of light and intensity and purity of color. A comparison of the values obtained with the standard specifications set up for railroad signals and the demarkation and illumination of airway routes and fields showed that while the green glasses are satisfactory, red and yellow lights do not always come up to required standards. The values of the coordinates of the three colors prescribed are given for different sources of light (electricity, oil, kerosene, etc.). M.HA.

Construction of a continuous batch furnace for making neutral glass. D. B. GINZBURG AND V. P. SUROVTSEV. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940,** No. 8, pp. 89–90; *Khim. Referat. Zhur.*, **4** [7–8] 93 (1941).—The authors describe the rebuilding of a glassmelting furnace according to their plans. After the rebuilding, the yield per 1 sq. m. of surface was 470 kgm. instead of the 210 kgm. formerly obtained. The cost of fuel was lowered accordingly. See "Rationalization . . .," *Ceram. Abs.*, **19** [3] 64 (1940). M.HO.

Development of the optical industry in the last 20 years. MILOTA FANDERLIK. *Sklářské Rozhledy*, **19,** 51–53 (1942); abstracted in *Chem. Zentr.*, **1942, II** [4] 446.—The technical progress in the field of optical glasses, grinding, etc., is reviewed. M.V.C.

Enemy-owned patents made available to U. S. glass industry. ANON. *Glass Ind.*, **24** [3] 101–103, 129 (1943).—Glass patents vested in the Alien Property Custodian are summarized. A.P.

Gazosteklo (frothed glass) as a building and heat- and sound-insulating material. I. I. KITAĬGORODSKIĬ. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940,** No. 8, pp. 31–32; *Khim. Referat. Zhur.*, **4** [7–8] 94 (1941).—K. describes the principles underlying the production of frothed glass as worked out by him and L. M. Butt, T. N. Keshishyan, V. I. Bokunyaeva, and V. P. Surovtsev. Frothed glass is prepared by heat-treating a mixture of glasslike powder and a gas-producing substance. The temperature is 150° to 200° higher than that at which the glasslike powder softens. The structure of the frothed glass depends on the relation between the gas-forming substance and the glasslike powder as well as on the conditions of the thermal treatment. Various kinds of frothed glass are described. See "Producing . . . ," *Ceram. Abs.*, **20** [1] 14 (1941). M.HO.

* Obtained from microfilm.

Glass after the war. ALEXANDER SILVERMAN. *Bull. Amer. Ceram. Soc.*, **22** [7] 217–22 (1943).—2 figures. See *Ceram. Abs.*, **21** [3] 59 (1942); "Benefits. . . ," *ibid.*, [10] 210.

Glass-block gatehouse saves critical materials. ANON. *Eng. News-Record*, **130** [18] 658 (1943).—Nontransparent light-diffusing glass blocks are used in the walls of a gatehouse which guards the entrance to a midwestern manufacturing plant. G.A.K.

Glass fabric for electrical insulation. ANON. *Engineering*, **155** [4038] 452 (1943).—Glass-fiber cloths and tapes used for electrical insulation are of high thermal conductivity and tensile strength. The density of glass wool is about 8 lb. per cu. ft.; that of glass-fiber tapes is ten times as great, and the thermal conductivity is higher than that of paper, cotton, or silk. In dielectric strength there is little choice between unimpregnated glass, cotton, or asbestos. Two main types of glass fiber are made for textile purposes, staple and continuous. The mechanical properties of glass-fiber fabrics for insulation purposes are discussed. G.A.K.

Glass-fiber insulation for electrical machinery. A. HEMSLEY. *Elec. Eng.*, **1941,** 372–76; abstracted in *Jour. Soc. Glass Tech.*, **25** [110] 251 (1941).—Two methods of manufacturing glass fiber, the staple fiber process and the continuous filament process, are briefly described, and details are given regarding the characteristics and properties of glass-fiber insulation, including values for temperature resistance and tensile strength. Mention is made of varnishes used in conjunction with glass and the application of glass insulation to traction motors, alternators, and transformers.

New ways of glass coloring. A. N. DAUVALTER. *Stekolnaya Prom.*, **1939,** No. 12, p. 25; abstracted in *Jour. Soc. Glass Tech.*, **24** [106] 338 (1940).—Various shades and tints forming irregular designs and producing attractive effects on the surface of glass objects have been obtained by introducing 0.3 to 0.4% Ag in a glass of the following composition: SiO_2 72.4, CaO 8.97, Na_2O 13.92, K_2O 4.02, SnO_2 0.34%. The silver is obtained from the waste from solutions for silvering mirrors. This glass is suitable for art objects as well as for jewelry.

Physicochemical researches on the fine structure of glasses: IV, Changes of the fine structure in the system P_2O_5–ZnO. E. KORDES. *Z. Physik. Chem.*, **B50,** 194–212 (1941); *Chem. Abs.*, **36,** 1232 (1942).—The curves of the refraction and density of the glasses in the system P_2O_5–ZnO show a break at 50 mol. %. The curve of the molecular refraction of the zinc phosphate glasses is smooth at 60 mol. % ZnO. The conclusion is that the ZnO-P_2O_5 glass has a SiO_2 or cristobalite structure. By means of the ionic radii and with this hypothesis, the observed curves of refraction and density can be calculated up to 50 mol. % ZnO with great accuracy and above 50 mol. % with complete accuracy. For Part III see *Ceram. Abs.*, **21** [8] 167 (1942).

Preston Laboratories improve glass-testing technique. ANON. *Ceram. Ind.*, **40** [6] 59 (1943).—Work at the Laboratories during the first quarter of 1943 is summarized. H.T.

Production of metallic ornamentation. FRANZ CARL WEBER. *Keram. Rundschau*, **48** [50] 424–25 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 1082.—The reduction technique for the manufacture of luster glasses is described. Oxalic acid and resinous sawdust have proved to be good reducers. Another process consists in combining resinates in the form of lusters and vitrifiable pigment. M.V.C.

Progress in technical development and research under the auspices of the Glass Delegacy during the year 1941–1942. ANON. *Jour. Soc. Glass Tech.*, **26** [118] 241–53T (1942).—The Annual Report of the Glass Delegacy for the year ending July 31, 1942, is presented. R.H.B.

Raman spectra of binary silicate glasses. M. F. VUKS AND V. A. IOFFE. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk*, **1938,** No. 3, pp. 61–69; *Chem. Abs.*, **34,** 6782 (1940).—Na glasses have 4, and Pb glasses 2, characteristic Raman lines, not corresponding with those of SiO_2. With rising SiO_2 content, the spectra gradually approach those of SiO_2. Na glass has a very intense line 940 to 960 $cm.^{-1}$, which gradually fades as the SiO_2 content rises and is ascribed to $Na_2Si_2O_5$. The shift in the spectrum observed as the Pb content is progressively raised corresponds with the substitution of Na by Pb atoms.

Refractive-index variations in glass at temperatures below 300°. N. A. TUDOROVSKAYA. *Izvest. Akad. Nauk S.S.S.R.*, **1938,** No. 1, p. 107; abstracted in *Jour. Soc. Glass Tech.*, **23** [95] 44 (1939).—T. gives the results of a study on refractive-index changes of a glass belonging to the Na_2O-SiO_2 system and containing free silica. The refractive-index measurements were made by means of the polarization interferometer designed by A. A. Lebedev which allows measurements within 3 to 5 units in the seventh decimal place. The study disclosed three regions of refractive-index changes: 85° to 120°, 140° to 165°, and 185° to 210°. X-ray analysis showed the presence of free silica in the form of a mixture of tridymite and cristobalite crystallites (10 to 20 a. u.). It is very probable that the refractive-index changes observed were caused by the transformation occurring in the tridymite and cristobalite crystallites present in the glass. See "Singularities. . . ," *Ceram. Abs.*, **17** [2] 65 (1938).

Removal of static charges from glassware by ultraviolet light. CLEMENT J. RODDEN. *Ind. Eng. Chem., Anal. Ed.*, **12,** 693 (1940); *Chem. Abs.*, **35,** 2 (1941).—If ultraviolet light is used to ionize the air around the glass vessel, the charge is dissipated rapidly. In general, it is recommended that the wiped object be exposed for 10 min. at a distance of about 2 ft. to a Hanovia Alpine sun lamp or a General Electric Lab.-Arc.

Role of sodium sulfate in glass manufacture: I–III. W. A. WEYL. *Glass Ind.*, **24** [1] 17–20, 39; [2] 65–68; [3] 108–11 (1943).—Sulfates enter glass as (1) sources of alkali or other basic oxides, (2) oxidizing and fining agents, and (3) reaction products derived from the atmosphere of the furnace or lehr. Because of the variable compositions of natural sodium sulfates, the chief source remains the by-product of hydrochloric acid manufacture by the Leblanc process. Experience gained with sodium sulfate-containing batches can be applied to other basic sulfates, particularly barium sulfate. Salt cake differs from soda ash in requiring a higher temperature for reaction with silica, unless carbon is included in the batch. The melted sulfate is not miscible with silicates and forms a very reactive floating layer of undiluted alkali. Reactions in the glass batch correspond to the second step of the Leblanc process. Sulfides and polysulfides form as intermediate reaction products and are remarkably stable in the melt. In some cases the presence of the layer of glass gall is desirable as a protection against reducing influence. Control over sulfate retention in the melt depends upon the equilibrium $SiO_2 + Na_2SO_4 = Na_2SiO_3 + SO_2 + {}^1/_2O_2$. The amount of sulfate will decrease with increasing silica in the glass, decreasing SO_2 concentration in the atmosphere, lack of oxygen, addition of reducing agents, or the presence of carbon monoxide in the furnace atmosphere. Because free sodium sulfate is stable in a glass melt up to high temperatures, making its alkali and oxygen available at a late stage in the melting, this compound is an excellent fining and oxidizing agent and a remedy against scum. Excessive sulfate injures the refractories, and fining efficiency is at an optimum at 0.4 to 0.5%, i.e., $^1/_{20}$ of the alkali as the sulfate. Small amounts of sodium sulfate also assist decolorizing by shifting the iron oxide equilibrium to ferric. Fe^{3+} ions, like Zn^{++}, stabilize sulfide ions in place of oxygens so that even in the presence of excess oxidizing agent the deep-brown color of ferric sulfide persists. The brown discoloration can be avoided by a proper carbon to sulfate ratio, careful mixing, and blocking. Sodium sulfate has too low an oxidation potential to reconvert manganese to its pink trivalent state; when manganese is to be used as a decolorizer, therefore, it should be added only after the carbon is consumed. Since the sulfur dioxide liberated from the melt cannot be economically recovered in the glass plant, it has been suggested that the alkali plants convert the sulfate to silicate,

regain the sulfur, and offer the fritted silicate as a batch ingredient for the glass industry. When a furnace atmosphere contains water vapor, oxygen, and sulfur dioxide, reaction with the alkali of the glass forms alkali sulfate, especially at temperatures below those for melting and fining. Exposing glassware to a sulfur dioxide-containing atmosphere improves the chemical resistivity and mechanical strength. The optimum sulfate additions to batches and the sulfate to carbon ratio are best determined from experience. Sulfate-containing glasses are susceptible to delayed development of seediness when the furnace atmosphere or temperature fluctuates. Because of its volatility, sodium sulfate may condense in the superstructure of a tank and increase refractory attack. In the glass melt, the sulfate content increases corrosiveness only above 1200°C. and with aluminous and porous refractories. Sulfate rarely causes trouble in the finished product. 46 references. A.P.

Spectrophotometric investigations on iron oxide-containing soda-lime-silica glasses: I, Influence of concentration and ferric-ferrous dissociation. T. H. WANG AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **26** [118] 272–95T (1942).—The series of soda-lime-silica glasses used by Densem and Turner in their study of the equilibrium between ferric and ferrous oxides in glasses (*Ceram. Abs.*, **18** [9] 238 (1939)) was investigated spectrophotometrically in regard to the visual region. The parent glass had the composition 75 SiO_2, 10 CaO, and 15% Na_2O, and iron oxide (0.002 to 12.5%) expressed as Fe_2O_3 was progressively introduced. At concentrations below 0.6% iron oxide, a linear relation between absorption and degree of ferric oxide dissociation held approximately true within the range of dissociation of about 13 to 35%. Extrapolation showed that the ferric iron at low concentrations contributes a greenish-yellow color, while ferrous iron gives a blue color to the glass. At high concentrations the ferric iron caused high absorption, particularly in the blue-violet end, resulting in a brown or pale-brown color. This high absorption component is sensitive to heat-treatment. The results show that in attempts to formulate a theory of the decolorizing of glass, deductions based on glass containing other than small amounts of iron oxide are inadmissible. R.H.B.

Stones in the glass of the Moscow laboratory-glassware plant. D. S. BELYANKIN AND V. V. LAPIN. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk*, **1940**, No. 3, pp. 81–88; *Chem. Abs.*, **35**, 8227 (1941).—The average composition of the glass is SiO_2 72.72, CaO 5.96, MgO 3.64, Na_2O 16.38, and K_2O 1.30%. Most of the rejected glass contained light-colored impurities. The dark-colored impurities were found in glass samples clinging to grog in the feeder. The index of refraction of the glass containing light-colored impurities is considerably higher than that of normal glass. The coarser crystals are situated in the center; they are shown by optical properties and by the detection of P to be apatite. The formation of apatite is explained by the presence of 0.04% of P_2O_5 in dolomite. Detailed microscopic investigations of the dark drop in the glass showed that there are two zones of fine microscopical crystals; the inner zone containing dense accumulations of spinel and the outer zone consisting of more widely separated β-Al_2O_3 plates. The center of the drop and the interzonal glass are free from crystals. The β-Al_2O_3 plates exhibited strong double refraction. The dark impurities are derived from the grog brick in the feeder; the light-colored impurities originate from the dolomite in the mixture.

Visual spectrophotometry of glasses, with special reference to low-absorption glasses. T. H. WANG. *Jour. Soc. Glass Tech.*, **26** [118] 254–71T (1942).—The types of spectrophotometer designed primarily for the measurement of light absorption of homogeneous glass are generally not suitable, without modification, for the measurement of low absorption, especially in the case of glasses in which cords and strains are markedly present. A simple analysis shows that when using a small-sized source of illumination, such as the Pointolite lamp, the thickness of the specimen may have to be limited to 0.7 cm. If a broad uniform diffusing source is available, however, specimens up to 13 cm. thick can be studied without causing serious error. By this means, specimens in the form of rods and sheets can be studied by allowing the illuminating rays to be reflected internally. An apparatus constructed on this principle is described, and typical results are recorded. Its application to problems of low absorption, such as those occurring in the processes of decolorizing glasses, is discussed. The possibility of using comparatively thick glass specimens with Hardy's recording spectrophotometer is pointed out. R.H.B.

SEPARATE PUBLICATION

Method of Measuring Radiation of Short Wave Length by Means of a Photochemical Reaction in a Special Glass. HELMUT LANDSBERG. *Penna. State Coll. Bull., Penna. State Coll. Studies*, No. 5, 30 pp. (1940); *Chem. Abs.*, **35**, 3905 (1941).—A glass containing 0.45% V_2O_5 and 0.45% CeO_2 undergoes a series of color changes on illumination by light of 3400- to 4000-a.u. wave length, changing from green through yellow and pink to purple. Heating regenerates the original color. The color changes can be used to measure the total amount of light energy, of the effective wave length, which has fallen upon the glass with a precision of 10% of the saturation energy. The use of rods of the glass 1 mm. in diameter is recommended; at greater thicknesses the coloration is not uniform. With these rods, saturation was reached on exposure to 16×10^8 erg $cm.^{-2}$ of sunlight. Glasses with higher Ce contents proved less sensitive. The cheapness and ease of handling of the rods render them especially useful for climatic studies, where high precision is unimportant.

PATENTS

Apparatus for making hollow glass products. E. L. MIKHLIN. Russ. 56,928, April 30, 1940. 32*a*. 12. M.Ho.

Apparatus for sealing containers. H. E. STOVER (Anchor Hocking Glass Corp.). U. S. 2,321,779, June 15, 1943 (Aug. 2, 1940).

Arrangement for drawing plate glass. B. G. KOLDAEV. Russ. 56,833, April 30, 1940. 32*a*. 23.01.—Plate glass is drawn with the aid of a Fourcault boat. The device consists of two adjacent basins separated by a partition below the level of the molten glass. Structural details are given. M.Ho.

Arrangement for heating a ribbon of glass drawn from the melt. S. I. KOROLEV. Russ. 56,935, April 30, 1940. 32*a*. 23.01.—The glass ribbon is heated throughout its width by a gas flame. The gas is fed into tubes arranged parallel to the width of the ribbon and provided with perforations through which the gas escapes to be burned. M.Ho.

Automatic glass-cutting machine. K. E. SOMMERFELD (Sommerfeld Machine Co.). U. S. 2,323,686, July 6, 1943 (Aug. 17, 1940).

Automatically annealed glass sheet. I. I. KITAĬGORODSKIĬ AND N. V. SOLOMIN. Russ. 56,936, April 30, 1940. 32*a*. 30.—The glass sheet is made of three or more layers of glass having different coefficients of expansion. These layers are either drawn simultaneously from the melt or superimposed one upon the other. In the latter case, this is done at a temperature at which the respective layers are soft. M.Ho.

Bench for cutting glass into negatives and similar plates. V. S. AKIMOV. Russ. 56,819, April 30, 1940. 32*a*. 33. M.Ho.

Blown glass article forming method. W. K. BERTHOLD (Dominion Glass Co., Ltd.). Can. 413,061, June 8, 1943 (Dec. 15, 1941). G.M.H.

Blown glassware article forming mechanism. W. K. BERTHOLD (Dominion Glass Co., Ltd.). Can. 413,062, June 8, 1943 (March 12, 1942; in U. S. Feb. 17, 1941). G.M.H.

Ceramic-to-metal seal. J. W. UNDERWOOD (Canadian General Electric Co., Ltd.). Can. 413,187, June 15, 1943 (Aug. 14, 1940). G.M.H.

Coated glass fiber strand. A. L. SIMISON (Owens-Corning Fiberglas Corp.). U. S. 2,323,684, July 6, 1943 (Feb. 7, 1942).

Container for molten glass. P. G. WILLETTS (Hartford-Empire Co.). U. S. 2,323,265, June 29, 1943 (March 28, 1938).

Drawing glass by the Fourcault method. S. I. KOROLEV. Russ. 56,934, April 30, 1940. 32*a*. 23.01.—Structural details of a device for drawing sheets, tubes, etc. M.Ho.

Fibrous glass manufacture. C. G. STAELIN (Fiberglas Canada, Ltd.). Can. 412,754, May 25, 1943 (April 29, 1941; in U. S. April 29, 1940). G.M.H.

Funnel and method of filtering. GEORGE ZARBO (Kimble Glass Co.). U. S. 2,321,639, June 15, 1943 (Sept. 7, 1939).

Glass-article manufacture. C. H. GREENE (Corning Glass Works). Can. 413,056, June 8, 1943 (Feb. 27, 1941; in U. S. March 1, 1940). G.M.H.

Glass article molding machine. W. K. BERTHOLD AND H. W. INGLE (Dominion Glass Co., Ltd.). Can. 412,909, June 1, 1943 (Jan. 14, 1941). G.M.H.

Glass-bottle mold. O. H. SAMUELSON. Can. 413,158, June 15, 1943 (May 23, 1942). G.M.H.

Glass composition. G. E. BARTON (Armstrong Cork Co.). U. S. 2,323,643, July 6, 1943 (Aug. 1, 1940).—A glass composition having high chemical durability and being suitable for the machine molding of bottles comprising 69 to 72.5 silica, 13 to 14.5 alkali metal oxide, 2.4 to 4.2 alumina, 10 to 12 lime, and 0.4 to 1% boric oxide.

Glass filament fabricating apparatus. PIERO MODIGLIANI (Fiberglas Canada, Ltd.). Can. 412,755, May 25, 1943 (Oct. 11, 1942). G.M.H.

Glass-opacifying method. H. H. BLAU (Corning Glass Works). Can. 413,058, June 8, 1943 (May 20, 1942). G.M.H.

Glass-severing apparatus. W. P. STUCKERT (Sylvania Electric Products, Inc.). U. S. 2,323,182, June 29, 1943 (Feb. 1, 1941).

Glass-severing machine. J. L. ANDERSON (Air Reduction Co.). U. S. 2,322,336, June 22, 1943 (Aug. 3, 1940).

Glass tube baking apparatus. R. M. GARDNER (Sylvania Electric Products, Inc.). U. S. 2,323,214, June 29, 1943 (May 28, 1941).

Glassware article moving apparatus. W. K. BERTHOLD (Dominion Glass Co., Ltd.). Can. 413,063, June 8, 1943 (May 12, 1942). G.M.H.

Glassware burning-off apparatus. W. L. MCNAMARA AND M. E. COMBS (Anchor Hocking Glass Corp.). Can. 413,176, June 15, 1943 (March 10, 1942; in U. S. March 31, 1941). G.M.H.

Glassworking apparatus. D. E. GRAY (Corning Glass Works). Can. 412,577, May 18, 1943 (Aug. 13, 1941). G.M.H.

Glassworking implement. H. W. RUSSELL (Anchor Hocking Glass Corp.). Can. 413,177, June 15, 1943 (April 15, 1942). G.M.H.

Guide for molten silicates. MAX AUWÄRTER, ALFRED JEDELE, AND KONRAD RUTHARDT (vested in the Alien Property Custodian). U. S. 2,323,000, June 29, 1943 (Sept. 21, 1940).—A spinneret for spinning glass threads.

Laminated glass. H. R. MARINI (Pittsburgh Plate Glass Co.). U. S. 2,322,582, June 22, 1943 (June 14, 1940).—A laminated glazing unit comprising a sheet of mesh material having its central portion open to define an endless framing member.

Lens-grinding machine. A. H. ROEHR (D. E. Jordan). U. S. 2,321,247, June 8, 1943 (March 8, 1940).

Lens grinding or polishing machine. DOUGLAS TAYLOR. U. S. 2,323,164, June 29, 1943 (April 28, 1942).

Manufacture of seals between metal and glass bodies. PHILIPS LAMPS, LTD. (N. V. Philips' Gloeilampenfabrieken). Brit. 553,182, May 26, 1943 (Nov. 19, 1941).

Manufacture of sheet glass. F. L. BISHOP AND L. P. FORMAN (American Window Glass Co.). U. S. 2,321,975, June 15, 1943 (May 19, 1938).

Metal-to-glass seals of medium size. G. LIEBMANN AND CATHODEON, LTD. Brit. 553,350, June 2, 1943 (Nov. 20, 1941).

Method for making metalloceramic products. YU. R. RAĬKHLIN AND A. M. ZARKHIN. Russ. 56,975, April 30, 1940. 40*b*. 17.—Such products are made from powdered metals to which may be added diamond dust. The molded powder is saturated with molten copper under pressure. M.Ho.

Mineral wool producing apparatus. JOHN PAGE (Canadian Gypsum Co., Ltd.). Can. 413,027, June 8, 1943 (Sept. 21, 1940; in U. S. Nov. 18, 1939). G.M.H.

Mirror. W. F. BROWN (Libbey-Owens-Ford Glass Co.). U. S. 2,321,987, June 15, 1943 (Aug. 4, 1940).—A mirror comprising a sheet of golden colored transparent glass formed from a soda-lime-silica batch to which are added cerium hydrate and titanium dioxide and a reflective backing on the glass sheet formed from a silvering solution.

Molten-glass feeder. W. C. WEBER AND E. H. WELLECH (Corning Glass Works). Can. 412,741, May 25, 1943 (July 8, 1941). G.M.H.

Nonglare glass building block. G. M. RAPP (Pittsburgh Corning Corp.). U. S. 2,322,591, June 22, 1943 (April 19, 1940).

Process and apparatus for sanitizing glassware. G. A. MENGLE (Brockway Glass Co.). U. S. 2,321,152, June 8, 1943 (May 7, 1941).—In the processing and capping of glass bottles, the steps of subjecting the bottles in an annealing lehr to a temperature of approximately 1000°F., lowering the temperature of the bottles to below 180°F. in the lehr by exposing them to a cooling atmosphere, bactericidally treating with ultraviolet light the atmosphere which contacts the bottles when their temperature is below approximately 180°F., removing the bottles from the lehr directly into an atmosphere treated bactericidally with ultraviolet light, and capping the bottles in the atmosphere.

Pulverized material molding method. C. H. GREENE (Corning Glass Works). Can. 413,057, June 8, 1943 (Feb. 27, 1941; in U. S. March 1, 1940). G.M.H.

Sealing glass making method. R. H. DALTON (Corning Glass Works). Can. 412,904, June 1, 1943 (July 18, 1941; in U. S. July 20, 1940). G.M.H.

Tank for molten glass. JOSEPH GASKELL (Pilkington Bros., Ltd.). U. S. 2,321,480, June 8, 1943 (Sept. 12, 1939).

Vitreous surface luminescent coating process. L. F. BRITTEN, H. G. JENKINS, AND A. H. MCKEAG (Canadian General Electric Co., Ltd.). Can. 412,554, May 18, 1943 (June 12, 1940).—The process comprises coating a vitreous surface with a decomposition product of a suspension of luminescent material in a solution of alkyl alkacrylate. G.M.H.

Wax impregnated glass fabric liner and gasket seal. E. E. LAUER (Merck & Co., Inc.). Can. 412,988, June 1, 1943 (Oct. 25, 1940). G.M.H.

Yellow fluorescent material and method of making. W. A. WEYL (American Optical Co). U. S. 2,322,265, June 22, 1943 (Jan. 2, 1941).—A material having a yellow fluorescence resulting from heating a mixture of oxides of zinc and vanadium to a temperature within the range of 600° to 900°C.

Structural Clay Products

Brick dimensions and bricklaying time. SD. *Z. Ver. Deut. Ing.*, **85** [33-36] 761 (1941); *Bldg. Sci. Abs.*, **14** [10] 157 (1941).—In experiments planned by the German Academy for Building Research (Deutsche Akademie für Bauforschung) test wall sections were built under the same external conditions (season, weather, place of erection) of the same thickness and design with 4 types of blocks of differing sizes in order to determine the influence of block size on working time. The brick used were as follows: sand-lime brick of standard size, 25 x 12 x 6.5 cm.; pumice

concrete T blocks of 3.3 times the volume of the standard size; perforated clay blocks with longitudinal perforations arranged as formerly, 25 x 25 x 15 cm.; and pumice concrete hollow blocks 25 x 25 x 25 cm. The same four bricklayers built four test wall sections with each type of block, i.e., 16 sections in all, the total volume of which was 27.77 $m.^3$ accurately measured. In the total working period of 4924.69 min., the time required for 8654 details was measured with a stop watch. The time required decreases considerably, especially for laying the blocks, with increasing block size, but in such details as spreading the mortar, stretching the cord, etc., there is also an economy of time. For bricklayer's work, the time required was 4.45 hr. per $m.^3$ in the case of the test walls of standard-size brick but only 1.6 hr. per $m.^3$ in the case of hollow-block walls. This economy of time in bricklaying is, of course, in view of the limited strength of the bricklayer, limited to a certain weight of block. What that limit is was not determined by the tests described.

War Council of the Structural Clay Products Institute. DOUGLAS WHITLOCK. *Bull. Amer. Ceram. Soc.*, **22** [7] 214–17 (1943).

Refractories

Cooperative investigation of the factors influencing the durability of the roofs of basic open-hearth furnaces: Foreword. T. SWINDEN AND A. T. GREEN. *Jour. Iron & Steel Inst.* [London], **144** [2] 204–205P (1941). **I, Manufacture of the roof brick and their properties before use.** T. R. LYNAM, J. H. CHESTERS, AND T. W. HOWIE. *Ibid.*, pp. 206–12P. **II, Furnace and pyrometer installation.** J. E. DOYLE, W. J. COLLINS, AND J. E. PLUCK. *Ibid.*, pp. 212–17P. **III, Furnace campaign: (1) Conditions of service with particular reference to the temperature gradient through the roof.** A. E. DODD. *Ibid.*, pp. 218–31P; (2) **Nature of the dust in the atmosphere in a basic open-hearth furnace.** J. H. CHESTERS AND W. HUGILL. *Ibid.*, pp. 231–34P; (3) **Draft conditions during the campaign.** J. E. DOYLE AND W. J. COLLINS. *Ibid.*, pp. 234–35P; (4) **Details of repairs to the roof during the campaign.** J. E. PLUCK. *Ibid.*, pp. 235–37P. **IV, Examination of samples taken from the roof at the end of the campaign.** J. H. CHESTERS, B. W. METHLEY, T. R. LYNAM, T. W. HOWIE, AND A. E. DODD. *Ibid.*, pp. 237–47P. **V, Results of X-ray studies of the raw material and of used silica brick from the open-hearth furnace roof.** A. H. JAY. *Ibid.*, pp. 247–50P. **VI, Microstructure of used roof brick.** W. HUGILL. *Ibid.*, pp. 250–58P. **VII, General conclusions.** *Ibid.*, 258–62P.—The results of observational work on the roof of a basic open-hearth steel furnace are reported. The observations commenced with the raw materials from which the silica roof was made and ended with laboratory work on samples taken from the roof at the close of the campaign. During the campaign itself a pyrometric record was made of the temperature at the surface and at various levels within the roof. The raw quartzite contained a proportion of comparatively large grains which were more readily converted than the remainder of the rock; this was attributed to strain within the lattice. The amount of tridymite produced in the fired product was to some extent dependent on the fineness of grinding. On warming up an open-hearth furnace, care must be taken in controlling the pull of the stack; if the stack damper is suddenly opened before gassing, the temperature of the roof may fall 200° to 300°C. in a few minutes. The readings of the radiation pyrometer focused on the roof in a large measure confirm the findings of American workers; in particular, temperature fluctuations of the order of 300°C. occurred during charging. In addition to these violent changes in temperature, however, fluctuations of about 50°C. occurred at each reversal; these variations were substantiated by thermocouple readings. The pyrometer record served to show that during the first two weeks of the campaign the temperature gradient near the hot face became greatly modified; this effect is assumed to be associated with the "seasoning" of the roof. Other important factors bound up with seasoning may be the marked decrease in porosity and the slight increase in refractoriness of the cristobalite zone. At a later stage in the campaign the roof became hotter at the tapping than at the charging side. Sampling of the dust and slag carried by the waste gases showed that the furnace atmosphere is most dusty during charging; at this period the dust consists mainly of lime, but during melting, iron oxide predominates. The zonal appearance of the used roof brick was normal, but analysis showed that the iron oxide content of the cristobalite zone was a little higher than that of the tridymite zone, while the lime had concentrated nearer to the hot face than the pale-yellow zone usually assigned to it. This zone was almost impermeable, owing to a narrow band of calcareous glass; its refractoriness was 1640°C. when powdered and rebonded. Several samples had cracked laterally in the region of this glassy band. The high temperature attained by the brickwork when a charge foams and the deleterious influence of foaming on the refractories have been confirmed.

Factors governing selection and acceptance of boiler masonry. G. BERTLING. *Wärme*, **64**, 250 (1941); *Brit. Chem. & Phys. Abs. B.*, *I*, **1942**, 57.—The highest probable wall temperature and the nature and composition of the slag govern the selection of the brick. The Al_2O_3 content and Seger cones for standard brick are tabulated. Acceptance tests should be based on constancy of weight and shape, impact strength, and tendency to crack.

Improved dolomite refractories. A. H. SCHALLIS. *Rock Products*, Sept., 1941; abstracted in *Trans. Brit. Ceram. Soc.*, **41** [1] 9A (1942).—In America, a basic refractory has been produced from dolomite for several years; the magnesia content is increased by the addition of brucite and serpentine, the lime being converted to the orthosilicate which is stabilized with chrome ore. Three methods are being investigated for the extraction of magnesia from dolomite: (*a*) leaching out the lime with water, (*b*) treatment of the slaked lime with hydrogen sulfide, and (*c*) extraction of the lime with sugar solution. See "Dolomite . . . ," *Ceram. Abs.*, **22** [5] 75 (1943).

Investigation of the effect of the surface crust of grog and silica brick on resistance to compression. R. L. PEVZNER. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk*, **1940**, No. 6, pp. 23–26; *Chem. Abs.*, **36**, 1452 (1942).—Refractory grog brick in the form of 50-mm. cubes showed fusing points of 1600° to 1740°; deformation under load of 2 kgm. per sq. cm. produced a 40% compression at 1280° to 1460°; volume porosity was 24.0 to 38.2%. The silica brick showed a fusing point of 1670°, a volume porosity of 25%, and a density of 2.39. The density of grog articles and the resistance to compression increase with increase in the total surface of the grog grains, owing to the increase of the amount of fine fractions (less than 0.5 mm.). The surface crust has no material effect on the results of the determinations; some cubes without any crust produced better results than cubes with one or two crusts. In setting new standards for refractory articles, the requirement of a maximum amount of unbroken faces can be omitted. 5 references.

Measurement and interpretation of surface temperatures. G. A. DOWNSBROUGH AND C. B. BRADLEY. *Ind. Heating*, **8** [2] 188–200; [3] 304–308; [4] 420–24 (1941).—D. discusses and describes the many sources of error which influence and falsify temperature measurements on surfaces. Some of the factors to be considered are roughness of surface, metal, insulating material, air currents, convection losses, absorption, and radiation. The proper selection of instruments such as thermocouples, pyrometers, etc., and the proper measuring methods are discussed. Illustrative examples are given. In general, field measurements of metal surface temperatures may be obtained with reasonable accuracy by using standard types of portable instruments (pyrometers) if appropriate in-

strument corrections are applied. Insulation temperatures cannot be accurately measured in the field with standard types of portable instruments unless the insulation is in contact with air at approximately the temperature of the surface. Surface temperatures alone are insufficient for determining the insulating efficiency or for comparing the efficiencies of different insulations. Exact measurements are better obtained in a laboratory. M.HA.

Magnesium progress in America: I, Producers; II, Raw materials; III, Production methods. E. V. PANNELL. *Metal Ind.* [London], **59** [21] 322–23; [22] 338–39; [23] 359–60 (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 151, p. 6 (1942).—P. gives an account of the development of Mg production in America up to the present production drive (with figures of annual production and prices), together with notes on companies dealing with the present situation. Raw materials and their preparation for Mg extraction and methods of extraction are also discussed.

Magnesium from the sea. D. H. KILLEFER. *News Ed.* (Amer. Chem. Soc.), **19** [21] 1189–93 (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 151, p. 6 (1942).—The new Mg plant of the Dow Chemical Co. at Freeport, Texas, and steps for the production of Mg from sea water are described. At present, the total Dow output is 36 million lb. of Mg annually. Other plants planned (list includes four more Dow plants and two others) will raise the output to 400 million lb.

Practical aspects of industrial-furnace insulation. JOHN W. DAWSON. *Metallurgia*, **27** [161] 177–80 (1943).—The proper application of high-temperature insulating firebrick provides economy in fuel. High- and low-temperature insulating brick should be used in conjunction with each other whenever conditions permit, but mechanical stability should be the first consideration. Hot-face insulation adapted to furnaces previously lined with firebrick reduced the time required to reach the working temperature 80%. E.C.P.

Properties of national zirconium ores. FREDERICO B. ANGELERI. *Anais Assoc. Quím. Brasil*, **1** [4] 225 (Oct., 1942).—Brazil owns the best and largest deposits of zirconium ores in the world, but their use as refractories in the country is small and the bulk of the production is exported. A. calls attention to the contradictions encountered in the technical literature regarding the properties of zirconium and its products. Testing five samples of zirconium ores from the Caldas plateau, he examined their heat resistance, sintering (controlled by specific gravity), and temporary thermal expansion. X-ray diffraction tests on these minerals showed that no free silica is present, the materials being essentially a mixture of both zirconium oxide and silicate. From three of the samples A. prepared fine-grained batches free of any binding agent. The preparation of the test samples is described. After being fired at 1400° and 1500°C., the samples were submitted to various tests. Under a load of 2 kgm. per cm.^{2}, a high initial softening temperature of 1580° to 1590° C. was exhibited by some of the samples. Zirconium minerals for use as refractories must possess adequate chemical composition and grain size. A. points out the characteristic properties of the zirconium refractories manufactured in Brazil, calling attention to their inferior quality. He mentions the application of zirconium minerals in Brazil as a lining for electric furnaces of small capacity as a substitute for granulated magnesite. The possibility of preparing zirconium refractories of high quality without the addition of binding agents is discussed. The precalcination of the minerals improves the quality of the products. Illustrated.

Refractories for desulfurizing ladles. C. E. BALES AND D. R. SMITH. *Ind. Heating*, **10** [5] 728, 732–36; [6] 886–94 (1943).—The more effective desulfurizing of molten iron in the ladle by the wider use of duplexing processes in steel production is discussed in full. As soda ash, caustic soda, and soda-bearing slags are very corrosive to most refractory materials, the search for better linings has led to the use of a plastic ramming refractory made of carefully selected highly calcined Kentucky flint clay blended with a minimum amount of high-grade ceramic bond clay; this gives a hard dense refractory lining free of joints and uniformly resistant to the cutting action of soda slags. A service record of two such linings in different plants is given:

	Plant A	Plant B
Thickness of rammed lining (in.)	5	5
Labor for lining ladle (hr.)	20	16
Time operated each day (hr.)	8	8
Time operated each week (days)	5	4
Metal poured each day (tons)	150	100
Temperature of metal (°F.)	2800	2850
Amount of soda ash used (lb./1½ min.)	2	2
Metal treated per lining (tons)	10,000	6400

Plastic refractories made from brickbats should not be used for desulfurizing ladle linings, as they are too porous. The successful performance of the plastic lining discussed is due to the development of large quantities of mullite crystals on the exposed face of the lining where the soda reacts with the refractory (mullite being the most refractory mineral of the silica-alumina series). Directions for lining the ladles are given in detail, and the following thicknesses are recommended for ladle covers: 4½ in. for ladles with a capacity of 1000, 1800, and 2500 lb.; 6½ in. for those of 3000- to 8000-lb. capacity; and 7 in. for a ladle of 20,000-lb. capacity. The lining should be air-dried 12 hr.; then all vent holes in the sides, bottom, and spout should be opened through the insulating material. The final heating and drying process with wood and coke fire is carried out for 12 hr. In a proper drying process, about 3 gal. of water should appear. M.HA.

Refractories in wartime. T. W. HOWIE. *Metallurgia*, **27** [158] 59–60 (1942).—Stabilized dolomite brick have been successfully substituted for magnesite brick in fixed basic open-hearth furnace back walls and in electric-arc furnace side walls, giving a life equal to chrome-magnesite brick in each case. It should be possible to make forsterite brick for the same purpose from serpentine rock. Where magnesite brick are still essential, they are made from magnesia extracted from sea water by the Chesny process. Silica roof brick require careful control of the roof temperature by a pyrometer. High-alumina brick are more likely to give good service as checker brick in the open-hearth furnace when there is volatilization of zinc from galvanized scrap. E.C.P.

Use of aluminum metal in the ceramic industry: II, Effect of coating insulating firebrick with aluminum-fireclay mixtures. H. G. SCHURECHT AND J. F. MCMAHON. *Jour. Amer. Ceram. Soc.*, **26** [7] 212–17 (1943).—3 references, 5 figures.

SEPARATE PUBLICATIONS

Burning Rate of Natural Graphite. GLEN DALE COE. *U. S. Bur. Mines Repts. Investigations*, No. 3692, 9 pp. (1943). Free.—Methods are given for ascertaining specific burning rates by the use of arithmetical derivatives to graphite oxidation curves. C. compares the burning rates of Madagascar, Ceylon, and four domestic graphites and concludes that the domestic graphites have about the same burning rate for equivalent sieve sizes as Madagascar flake and a much lower burning rate than crystalline graphite from Ceylon. R.A.H.

Refractory Properties of Washington Chromite. HEWITT WILSON, KENNETH G. SKINNER, AND THOMAS L. HURST. *U. S. Bur. Mines Repts. Investigations*, No. 3694, 31 pp. (1943). Free.—Tests made with Washington chromite to determine its possible utilization in refractories are described. Oregon and California chromites were included in the tests for comparison. R.A.H.

PATENTS

Dressing of earth minerals. S. B. THOMAS (Shell Development Co.). U. S. 2,322, 674, June 22, 1943 (Nov. 30, 1940).—In a process for the preparation of activated

bauxite from natural bauxite ores containing ferrous iron impurities, the improvement which comprises activating the iron-containing bauxite ore at a temperature of about 250° to 500°C. in an atmosphere of steam sufficiently oxidizing to convert ferrous compounds to magnetite, but insufficiently oxidizing to oxidize magnetite to ferric oxide, to convert ferrous iron impurities predominantly to magnetite, to reduce the water content of the bauxite to that corresponding to the maximum adsorptive activity, and subjecting the bauxite activated in this manner to a magnetic separation, whereby there is obtained an activated bauxite concentrate relatively free of iron and an activated bauxite concentrate high in iron.

Furnace-wall construction. L. H. HOSBEIN (M. H. Detrick Co.). U. S. 2,323,661, July 6, 1943 (Oct. 18, 1939; July 29, 1941).—A tile for furnace construction comprising a refractory block, one of the side faces having a plurality of recesses therein communicating with the rear face.

Magnesite for furnace linings. R. E. BIRCH AND C. L. THOMPSON (Harbison-Walker Refractories Co.). U. S. 2,322,274, June 22, 1943 (Dec. 4, 1940).—That method of making a furnace lining comprising forming the lining from a formable mixture of sodium silicate with dead-burned magnesite intimately admixed with more than about 0.5 to 5% of free lime and firing the lining after it has set.

Process for the production of alumina and magnesia. J. G. STEIN & CO., LTD., J. F. HYSLOP, AND R. MACKENZIE. Brit. 553,034, May 19, 1943 (Dec. 4, 1941).

Refractories. G. V. KUKOLEV AND I. E. DUDAVSKIĬ. Russ. 56,953, April 30, 1940. 80*b*. 8.18.—Refractory products are made by pressing heated raw materials. For better results and to speed up the process, $MgCl_2$, $MgSO_4$, or $CaCl_2$ is added to the material to be pressed. M.Ho.

Refractories. G. V. KUKOLEV AND I. E. DUDAVSKIĬ. Russ. 57,059, May 31, 1940. 80*b*. 8.02.—Refractories are made from dolomite to which natural Mg silicates, such as serpentine, olivine, etc., have been admixed. These are added to lower the sintering temperature and to increase the density of the clinker. The quantity of the Mg silicates added is such that all the Ca carbonate is tied up as a silicate to form $3CaO \cdot SiO_2$ and simultaneously all the Fe and Al are tied up in the mix. M.Ho.

Refractory-panel construction. J. H. HENZEL. U. S. 2,321,813, June 15, 1943 (July 1, 1942).

Terra Cotta

Blowout fault in sanitary fire-clay ware. A. J. DALE AND MARCUS FRANCIS. *Tech. Paper Brit. Pottery Research Assn.*, Dec., 1938; reprinted in *Trans. Brit. Ceram. Soc.*, **42** [3] 21–41 (1943).—Illustrations are given of examples of the fault as it occurs both in works' practice and in the laboratory. The different types of mineral contaminations of the natural fire clay are described, and attention is drawn to those which, under laboratory conditions, have been found to cause the fault. The effects of size of the particles, their distances below the surface, thickness of engobe and glaze, rate of heating, and nature of the surrounding atmosphere have been considered. The fault may be avoided by (1) weathering the clay, (2) reducing the size of the fire clay and its impurities, (3) grinding coarsely and sieving through a finer sieve (20-mesh), (4) grinding normally and sieving through a finer sieve, (5) modifying the firing schedule, and (6) eliminating dangerous minerals by methods used in the metallurgical industry for refining ores. R.A.H.

Whiteware

Biscuit-firing schedule for ceramic goods. A. J. DALE AND MARCUS FRANCIS. *Tech. Paper Brit. Pottery Research Assn.*, May, 1939; reprinted in *Trans. Brit. Ceram. Soc.*, **42** [3] 42–56 (1943).—The biscuit-firing schedule is considered from the viewpoint of the changes occurring in its four phases, viz., the water-smoking, oxidation, vitrification, and cooling periods. R.A.H.

Effect of opacifiers on fused viscosity of feldspathic glazes. JAMES R. BEAM. *Jour. Amer. Ceram. Soc.*, **26** [7] 205–12 (1943).—9 references, 13 figures.

Lead-free and boron-free whiteware glazes. HEINRICH ROCH, JR. *Sprechsaal*, **73**, 135–36 (1940); *Chem. Abs.*, **34**, 6784 (1940); see "Viewpoints . . .," *Ceram. Abs.*, **19** [7] 167 (1940).

Machinable ceramic high-frequency insulator. M. KOBAYASI, Z. KAMAYATI, AND S. HATTORI. *Electrotech. Jour.* [Japan], **5**, 40 (1941); *Chem. Abs.*, **36**, 1152 (1942).—A machinable ceramic material of low power factor is described. Some of its properties are as follows: dielectric strength, 12 to 16 kv. per cm.; specific resistivity at 29°, 7.4×10^{14} ohm per cm.; specific gravity 2.3 to 2.4; and Shore hardness, 40 to 80. It is stable at 1000° and resistant to H_2O, most chemicals, and sudden temperature changes of 200°.

New type (chemical stoneware) funnels. ANON. *Chem. Age* [London], **48** [1243] 455 (1943).—Two new types of Büchner funnels are being manufactured in white chemical stoneware by Doulton & Co., Ltd., London, which overcome two of the drawbacks of the larger sized Büchner funnels: (1) the perforated plate is liable to collapse under extremes of vacuum and temperature (especially if these are combined); and (2) the underside of the perforated plate and the adjacent interior walls must be left unglazed because of manufacturing difficulties. The stoneware "semiporcelaneous" body has a good resistance to mechanical and thermal shock and is proof against all corrosive liquids (except hydrofluoric acid and hot strong caustic alkalis). This material permits a much more robust form of construction than is possible with porcelain, and, by making the funnel in two pieces which are afterward carefully ground and fitted together, it is possible to glaze the inside surfaces. One pattern consists of a standard Büchner top with a perforated base. The other pattern has a porous ceramic plate (of integral construction with the remainder of the top) in place of the usual perforations. These porous-bottom funnels are excellent where large quantities of the same type of liquor must be handled, the porous part replacing the more customary filter paper. Three standard porosities are stocked, and special pore sizes can be produced to meet specific requirements. A.B.S.

Resistance to alternating current of porous ceramic materials made of clay and partly of magnesium silicate (groups IVb and V of the DIN 40685 table) at temperatures up to 600°. E. F. RICHTER. *Physik. Z.*, **42**, 117–20 (1941); *Brit. Chem. & Phys. Abs. B.*, *I*, **1942**, 211.—Alternating current of 50 cycles and temperatures between 100° and 600° were used. The effect of temperature on the loss factor and on ϵ was determined and compared with results obtained for other groups of substances. See *Ceram. Abs.*, **19** [11] 259 (1940).

PATENTS

Bushing insulator. T. F. BRANDT (Ohio Brass Co.). U. S. 2,321,793, June 15, 1943 (Dec. 30, 1939; March 7, 1942).

Glaze containing neither boron nor lead. B. V. LYUL'EV AND B. I. SKAVRONSKIĬ. Russ. 56,870, April 30, 1940. 80*b*. 23.03.—For a glaze containing neither B nor Pb, a mix of the following composition is used:

Na_2O	0.1039–0.7762	Al_2O_3	0.2034–0.0908	SiO_2 2.7732–6.347 3
K_2O	0.0441–0.0878	Fe_2O_3	0.1024–0.0152	
MgO	0.0068–0.0081			
CaO	0.7789–0.1179			

M.Ho.

Molding of handles and other articles of pottery. W. BOULTON, LTD., AND W. R. STRATHERN. Brit. 553,422, June 2, 1943 (Feb. 14, 1942).

Spark plug. A. G. CATTANEO (Shell Development Co.). U. S. 2,323,792, July 6, 1943 (May 17, 1940; March 23, 1942).—A spark plug suitable for use in an ignition system for internal-combustion engines wherein a pressurized harness is utilized to inhibit high tension cable breakdown tendencies comprising a body member including a grounded electrode.

Spark plug and method of making. T. G. MCDOUGAL (General Motors Corp.). U. S. 2,321,840, June 15, 1943 (Jan. 23, 1942).—(1) In spark-plug manufacture, the steps of coating an insulator with a glaze-forming material, putting an electrode in place in the insulator, putting a glass sealing material adjacent the electrode, placing a conductor adjacent the sealing material, and heating the loose assembly to mature the glaze and soften the sealing material. (8) In a spark plug, an insulator having a high proportion of sintered oxides, a glaze coating having a maturing temperature within the range of Orton cones 010 to 02 on at least a portion of the insulator, an electrode and a terminal in the insulator, and two conducting glass seals joining the electrode and terminal, the glass of the seal adjacent the terminal having a greater plasticity than that of the seal adjacent the electrode.

Equipment and Apparatus

Apparatus in microvolumetric analyses. D. L. MASTERS. *Chem. Age* [London], **48** [1243] 439–42 (1943).—Micropipettes and burettes of several patterns are described and illustrated; some are accurate to ±0.0001 ml. A.B.S.

Capillary viscometers: the attainment of maximum accuracy. L. A. STEINER. *Chem. Age* [London], **48** [1243] 448–50 (1943).—Many published records of viscosity are unreliable because of insufficient knowledge of the details of the viscometers used. The fact that a viscometer complies with specified dimensions is not a guarantee that it functions properly as a precision instrument. Viscometers should be calibrated throughout their range and not only at one point, because a viscometer calibrated with one liquid may yield inaccurate results with a different liquid. Viscometers with long capillaries are usually more accurate than those with short ones. The British Standards Institution has issued a Standard Specification (No. 188/1923) for a viscometer of the capillary type. The Institute of Petroleum recommends three standard types. Detailed descriptions are given of the suspended level viscometer, the Fenske viscometer, and the W-tube viscometer, and several sources of error are indicated. With sufficient care, an over-all accuracy of 0.2% is readily attainable, but in routine work accuracy is often sacrificed for speed. Illustrated. A.B.S.

Development of alloys for use at temperatures above 1000°F. E. R. PARKER. *Trans. Amer. Soc. Metals*, **28**, 797–807 (1940); *Chem. Abs.*, **35**, 719 (1941).—Rupture tests were made with experimental Fe-base alloys containing Mo, Cb, and Ti at 1100°F. A critically dispersed precipitate offers maximum resistance to deformation at both high and low temperatures. Intermetallic compounds are more stable than carbides. High-temperature strength requires the presence of a critically dispersed stable compound.

Di-Met resinoid chipbreakers. ANON. *Bull. Amer. Ceram. Soc.*, **22** [7] 262 (1943).

Dust laboratory studies fan-abrasion problem. R. L. LINCOLN. *Power*, **84**, 100–101 (Nov., 1940).—Wear from abrasion is present to some extent in all fans handling dust-laden gases. To avoid this, the solids must be removed before the gas enters the fan wheel. L. describes the establishment of a laboratory to study just such problems. Practical research to reduce fan-wheel wear has developed vanes which not only control volume flow but separate out a high proportion of the unwanted materials. Ingenious model test arrangements are checked full size in the field as well as in the laboratory. The operation of large fans incorporating the volume-control and dust-separation vanes has been very successful. F.S.M.

Dynamic tensile properties and stress-strain diagrams of some construction materials. G. WELTER AND S. MORSKI. *Jour. Inst. Metals*, **66** [4] 97–107 (1940).—An apparatus is described in detail which gives the stress-strain relations at a rate of straining of 1 to 5 m. per sec. in metals as against the usual rate of straining of 10 mm. per min. in the ordinary static test. The test bar is dropped onto a ring which arrests its fall but allows a weight attached to the bar by a helical spring to continue its fall until the stress transmitted through the spring causes failure. A revolving drum records the stress as a function of strain. A comparison of the results of this method with those of the static test is given for a number of structural metals. V.D.F.

Flow of dry substances. I. LINCHEVSKIĬ. *Zhur. Tekh. Fiz.*, **9** [4] 343–47 (1939); abstracted in *Physik. Ber.*, **21** [23] 2263 (1940).—The flow of sand from or through an opening was investigated. If ω = the area, R = the radius of the opening, g = acceleration by gravity, and μ = a flow coefficient, the amount (q) flowing from the opening is given by $q = \mu\omega\sqrt{2gR}$. The value of μ was found to be 0.55 for sand. M.HA.

***History of viscometry.** F. HÖPPLER. *Kolloid. Z.*, **98** [1] 1–5 (1942).—A brief review of the measurement of viscosity is given. H. quotes corroborating evidence of the belief that the renowned physicist of antiquity, Amenemhet, an Egyptian born 1565 B.C., considered the function viscosity-temperature of water in connection with the construction of an hourglass. M.HO.

Humidity data expressed in grains of water vapor per pound of dry air. E. STANSFIELD. *Can. Jour. Research*, **21A** [5] 51–55 (1943).—For some purposes humidity is best stated as weight of water vapor admixed with unit weight of dry air, but this information cannot be found in the ordinary psychrometric tables. Tables and charts are given relating the air temperature, the depression of the wet-bulb thermometer and of the sling psychrometer, and the barometric pressure with the humidity in grains of water vapor per pound of dry air. The A.S.T.M. specifications for knock characteristics of motor fuels designate minimum and maximum limits of humidity for the air supplied to the engine. The depressions of the wet-bulb thermometer corresponding to these limits are shown in one figure. G.A.K.

Hyglo crack-detection process. ANON. *Engineering*, **155** [4033] 357 (1943); *Nature*, **151** [3837] 555–56 (1943).—The use of fluorescent materials and ultraviolet radiation for the detection of flaws, cracks, porosity, and other defects in ferrous and nonferrous metals, plastics, and ceramic materials reduces fatigue and eyestrain and eliminates the possibility of overlooking a defect. Fluorescent materials used are usually hydrocarbons dissolved in a solvent of a penetrating nature. The part is immersed in the solution, and any crack or fissure is filled with the fluorescent liquid. Fluorescent liquid on the surface is removed, and, on examination under ultraviolet light, flaws show up distinctly. G.A.K.

Large variety of utility ware pieces produced from fewer molds. ANON. *Ceram. Ind.*, **40** [6] 72–74 (1943).—The development of new designs in utility ware reduces production costs and saves labor and shipping and storage space. Illustrations show how it is possible to develop attractive shapes for various purposes, using only a few basic molds. Illustrated. H.T.

Lubricants containing soap solutions. ANON. *Machinery* [N. Y.], **49** [7] 166 (1943). R.H.B.

Metallic materials for thermocouples. A. SCHULZE. *Wärme*, **62**, 127–29 (1939); *Jour. Inst. Fuel*, **12**, 41–48S (1939); *Chem. Abs.*, **33**, 6092 (1939); **34**, 2213 (1940).—S.

* Obtained from microfilm.

reviews the progress made in the use of thermocouples for temperature measurement, particularly for temperatures greater than 1500°, and the principles governing the choice of material for thermocouples. Data on the thermoelectric force and useful temperature range of a large number of noble- and base-metal couples are included. See *Ceram. Abs.*, **18** [9] 250 (1939).

New precision instrument for measuring gloss. ANON. *Bull. Amer. Ceram. Soc.*, **22** [7] 261-62 (1943).

Porcelain gauge protector. ANON. *Chem. Industries*, **52** [5] 624 (1943).—The Lapp chemical porcelain snubber-type gauge protector is said to make possible the use of standard, direct-acting pressure gauges in systems handling corrosive liquids. The protector consists of a chamber of chemical porcelain enclosing a porcelain float ground and lapped to a smooth precision fit, the cavity between float and gauge being filled with oil. Pressure from the line is transmitted through the float to the oil above, and danger of seepage past the float is minimized by the smooth, tight fit and the fact that pressures above and below the float are equal. E.D.M.

Relative humidity. W. F. SCHAPHORST. *Chem. Industries*, **52** [5] 614 (1943).—A chart for determining relative humidity from wet- and dry-bulb temperatures, based on a special formula developed by the National Bureau of Standards, is presented. E.D.M.

Semimicro distillation. ANON. *Chem. Industries*, **52** [4] 477 (1943).—An all-glass apparatus used by Martin Maglio of St. John's University is illustrated. It may also be used as a reflux condenser. E.D.M.

Surface roughness analyzer. ANON. *Frontier* (Armour Research Foundation); *Chem. Industries*, **52** [4] 477 (1943).—The early instruments used for this purpose employed an optical system to magnify the angular motion imparted to a mirror by the tracer point. A radically different approach to the problem of obtaining magnification of 100,000× by the use of an electronic amplifier is described. A specially designed pickup, an electronic amplifier, and a direct inking oscillograph for recording the magnified amplitude of the tracer point movement are used. The pickup assembly consists of a piezoelectric crystal of Rochelle salt, the tracer point, and a positioning shoe with a supporting arm. When the pickup is connected to the amplifier, a voltage is developed proportional to the tracer-point amplitude, and the amplifier activates the oscillograph. The movement of the tracer point is controlled by a drive head powered by a synchronous motor which imparts a constant velocity reciprocating motion. The instrument can be calibrated, and its operation is simple. It may be used to obtain data on other surface characteristics as well as roughness. 1 diagram. E.D.M.

Surface tester. ANON. *Chem. Industries*, **52** [5] 626 (1943).—A new shear-hardness attachment for the Taber Abraser (Taber Instrument Corp.) is announced. It provides a method of measuring the toughness quality of surface finishes and their ability to resist digs, scrapes, and similar abuse from actual service not considered normal wear. A point cuts a groove in the surface, and from the depth of cut and the weight used the shear hardness is calculated. E.D.M.

Theory of size distribution of particles in a comminuted system. L. GRIFFITH. *Can. Jour. Research*, **21A** [6] 57-64 (1943).—The problem of the size distribution of particles in a system that has been ground can be treated by the general methods of the theory of probability. The mathematical procedure employed is almost identical in form with that used in determining the classical statistical mechanics of gases, although the fundamental ideas are different, as the molecules of a solid are not free to move. The distribution laws developed agree with the known empirical laws for particles of sizes down to about one micron, but proof of the theory will depend upon the study of size distributions in colloidal systems. G.A.K.

SEPARATE PUBLICATIONS

Contrasts in Grinding Characteristics of Mineral Products. GLEN DALE COE AND WILL H. COGHILL. *U. S. Bur. Mines Repts. Investigations*, No. 3704, 11 pp. Free.—This report contrasts the net energy consumed in grinding to a top limiting size and the size distribution of ground products for a number of minerals, including talc, sphalerite, topaz, limestone, siderite, chalcopyrite, rutile, quartz, chalcedony, zircon, bituminous coal, anthracite, bighead cannel coal, taconite, chert, and cement clinker. The report was prepared in cooperation with the University of Alabama. R.A.H.

Report on Oil-Engine Power Cost for 1941. Published by the American Society of Mechanical Engineers, New York, 1943. Price $1.25 (20% discount to members).—Executives and engineers concerned with the problem of economic power supply for industrial plants will find authoritative and useful data on the cost of operation of Diesel engines in this report. It has been compiled annually since 1929 by a subcommittee of the Oil and Gas Power Division, A.S.M.E., and has become internationally known as an impartial and accurate source of information on such matters as fuel- and lubricating-oil consumption and cost of supplies, maintenance, repairs, and supervision. The report covers 151 plants, giving complete operating cost figures on each with data on type of plant and equipment and conditions of operation. In addition, production costs for 140 plants reporting for two or more years are given; 100 of these plants have reported for five or more years and 38 for ten or more. These long-term comparative costs offer an excellent picture of true average costs, usefully supplementing the figures for 1941. Owners and operators of truck and bus fleets will find equally useful information in a section devoted to costs of Diesel engines in automotive service. This section, representing the third annual survey, presents vehicle and engine data and costs received from 15 owners and operators of Diesel-powered busses and trucks covering 762 vehicles.

PATENTS

Apparatus for determining the roughness of surfaces. H. SHAW. Brit. 553,108, May 19, 1943 (Dec. 2, 1941).

Brick grab. R. A. FONTAINE. U. S. 2,323,810, July 6, 1943 (Aug. 7, 1941). U. S. 2,323,811, July 6, 1943 (Jan. 28, 1942).

Centrifuge for separating granular material according to its specific gravity and size. N. N. UL'RIKH. Russ. 57,202, May 31, 1940. 82*b*. 3.10. M.Ho.

Classifier for powdered materials. A. M. NEMTINOV. Russ. 56,982, April 30, 1940. 1*a*. 6.—Structural details of the cone-shaped classifier. M.Ho.

Device for feeding granular materials from a hopper onto a conveyer. S. P. FEDOROV. Russ. 57,138, May 31, 1940. 81*e*. 11. M.Ho.

Dinnerware machine. W. H. EMERSON (Homer Laughlin China Co.). U. S. 2,321,471, June 8, 1943 (April 9, 1940).

Press for dry-pressing brick. F. D. RYZHKOV. Russ. 56,739, March 31, 1940. 80*a*. 19.01.—The press consists of a rotating cylinder on whose periphery are radially arranged molds. After the molds are filled, they are automatically closed and pressed. M.Ho.

Rock crushing and segregating apparatus. MELVIN OVESTRUD (Pioneer Engineering Works, Inc.). Can. 413,235, June 15, 1943 (Jan. 5, 1942). G.M.H.

Rotary drier for slimes and slurries. V. F. GLADKOV. Russ. 56,641, March 31, 1940. 80*a*. 19.01. M.Ho.

Sedimentation apparatus. P. V. LYASHCHENKO. Russ. 57,091, May 31, 1940. 1*a*. 4.—The sedimentation apparatus consists of several compartments. The light fraction is removed in each of these. For this purpose an inclined surface is attached to the partition separating two compartments in such a manner that the light fraction spills over this surface into a collecting trough while the heavy fraction proceeds on its course. M.Ho.

Kilns, Furnaces, Fuels, and Combustion

How far is the proximate analysis a reliable guide to coal behavior? J. G. BENNETT. *Jour. Inst. Fuel*, **14**, 175–83 (1941); *Brit. Chem. & Phys. Abs. B., I*, **1941**, 385.—The question of how far the volatile matter content of a coal is a reliable guide to its behavior on combustion, particularly in modern power plants, is discussed. The general conclusion drawn is that, up to approximately 26% of volatile matter, a fairly good correlation with the properties can be made from the volatile matter provided the coal is a bright unoxidized one, a fact which is not revealed by the volatile determination alone but which is shown by the complete analysis. Beyond approximately 26%, the volatile matter appears to be of very little value for accurate prediction of properties. From the complete analysis (elementary, volatile, and calorific value) and petrological analysis, a fairly good prediction can usually be made. As, however, the conditions of the practical utilization of coal vary so enormously, it appears necessary to supplement analytical methods by *ad hoc* laboratory tests appropriate to the actual conditions of practice. Too much attention has been paid to the improvement of analytical methods rather than to the interpretation of the results.

Oil-shale possibilities. J. E. WALKER. *Chem. Age* [London], **48** [1238] 323 (1943).—In Great Britain an oil shale may be even more valuable than petroleum as a basis for synthetic products and as a source of valuable cracking gases. A.B.S.

Sixty-five per cent of all heat available from coal is wasted. E. ATKINSON. *Ind. Power & Production*, **18** [200] 49–51 (1942).—A. discusses the insulation of steam pipes and some methods of surface-temperature measurement under the following headings: (1) organic bodies, (2) inorganic bodies, (3) glass silk, (4) diatomaceous earth, (5) covered-pipe losses, and (6) bare-pipe temperatures. G.A.K.

Technological effect of waste fuel gas on flue masonry. OTTO T. KORITNIG. *Emailwaren-Ind.*, **18**, 101–103 (1941); abstracted in *Chem. Zentr.*, **1942, II** [4] 484.—The composition and dew point of combustion gases and the possibilities of preventing the condensation of water vapor and the formation of H_2SO_4 from the SO_2 contained in the waste gases are discussed. M.V.C.

PATENTS

Tunnel kilns for firing ceramic ware. GENERAL MOTORS CORP. Brit. 552,878, May 12, 1943 (Dec. 4, 1941); addition to Brit. 488,262, July 13, 1938 (Jan. 4, 1936).

Tunnel kiln for firing chinaware. A. T. GEL'MAN AND E. G. SOLOV'EV. Russ. 57,078, May 31, 1940. 80*c*. 5.—Between the firing zone and the preheating zone are installed by-passes and atomizers. Their function is to regulate the gaseous medium independently of the burners in the firing zone. M.Ho.

Geology

Association of College Geology Teachers: reference list in earth sciences. L. R. THIESMEYER. *Jour. Geol.*, **51** [4] 276–83 (1943).—A useful list of publications of interest to ceramists and others is presented, classified under general geology, historical geology and paleontology, economic geology and geography, history of geology, geography and exploration, military geology, and earth's place in the universe (astronomy). They are keyed as to their interest for laymen (popularized science), for laymen and beginning students (textbooks and technical articles), and for juveniles. The list is obtainable at 10¢ each (25 or more at 5¢ each) from Prof. Percival Robertson, Geology Dept., The Principia, Elsah, Ill. A.C.B.

Bauxite in Mozambique. ANON. *Chem. Age* [London], **48** [1242] 431 (1943).—A survey of the bauxite deposit in the Mozambique Territory showed a total of about 2.4 million tons, only 68,000 tons of which are available for immediate consideration. Only 2000 tons showed sufficiently low silica content to be considered as a base for aluminum manufacture without further treatment. A.B.S.

***Belgian deposits of fluorine and their industrial importance.** L. CALEMBERT AND W. VAN LECKWIJCK. *Rev. Universelle Mines*, **18** [2] 41–43 (1942).—The exploitable occurrences of fluorine compounds, in particular fluorspar, in Belgian territory and the geological conditions are described; data are given for present production, eventual future developments, and the consumption in the different ceramic industries. M.Ha.

Beneficiation of domestic talcs. SIDNEY GOTTLIEB. *Bull. Amer. Ceram. Soc.*, **22** [7] 223–25 (1943).—4 references, 2 figures.

Cobalt. D. C. MCLAREN. *Can. Mining Jour.*, **64** [6] 341–50 (1943).—The chemistry and occurrence of cobalt minerals and their production and uses are discussed. G.M.H.

Constitution of kaolin and its behavior at high temperatures (silica and silicates): Determinations of specific gravities (110° to 1400°). F. W. MEIER. *Sprechsaal*, **73**, 99–101 (1940); *Chem. Abs.*, **34**, 6783 (1940). **Optical properties (microscopical and X-ray studies with Debye diagrams at 570°, 1000°, 1100°, 1300°, and 1400°).** *Sprechsaal*, **73**, 109–11 (1940). **Evaluation of results.** *Ibid.*, pp. 115–17.—The behavior of Zettlitz kaolin when heated at high temperatures is discussed. Kaolinite is stable up to 400°. Between 450° and 530° it is converted to the monohydrate. Under continued heating the remainder of the H_2O is lost between 800° and 1000°, and an exothermal partial dissociation into metastable sillimanite occurs. A stable crystal lattice forms between 1180° and 1260°. X ray determinations show that the kaolin, by its loss of H_2O at high temperatures, is converted into a new crystal species without proceeding through an amorphous phase. The sillimanite-mullite problem was not dealt with owing to the almost complete analogy of the two crystal forms. See *Ceram. Abs.*, **21** [9] 197 (1942).

Domestic talcs. T. A. KLINEFELTER. *Bull. Amer. Ceram. Soc.*, **22** [7] 225–27 (1943).—2 references, 1 figure.

Elasticity of clay paste. V. V. GONCHAROV AND N. N. MIKHAILOV. *Compt. Rend. Acad. Sci. U.R.S.S.*, **26** [1] 44–47 (1940); abstracted in *Physik. Ber.*, **21** [22] 2182 (1940).—The behavior of plastic clay was investigated under 20 to 30 load changes per sec. The ratio of tensile to compressive deflection, E', was designated as the dynamic elasticity modulus. The lag between tensile and compressive load deflections (σ_0 and ϵ_0, respectively) is represented by the hysteresis loop, $\sin\theta = F/\pi \times ab$, where a and b = length and width of the loop parallel to the axes and F = the planimetrically determined area of the loop. The energy produced in one load cycle and transformed into heat is $\pi\sigma_0\epsilon_0 \sin\theta$. Plastic clays possess elastic hysteresis; elasticity limit and elasticity modulus and deformation resistance decrease and degree of deformation and dampening increase with increasing humidity content. Clays of various origins showed very great differences in elastic properties for which the E' modulus can be considered characteristic. Plastic clays are thixotropic. M.Ha.

Fluorspar. W. H. REYNOLDS. *Chem. Age* [London], **48** [1239] 343–45 (1943).—Most of the impurities are separated by roughly crushing the fluorspar and picking them out. The purified product is then crushed according to its prospective use. For enamels and glass manufacture it is usually crushed to pass a 100-mesh screen, but some firms prefer a much coarser powder. The iron oxide con-

* Obtained from microfilm.

tent for glassmaking should not exceed 0.12%, with an average of half this amount. Silica is not injurious but is a reason for paying a lower price. The sulfides of lead and zinc and barytes should not exceed 1% each. Fluorspar rich in silica is usually rejected, but by suitable treatment (not described) the silica can be readily separated and sulfides can be removed by flotation. Adequate chemical analysis prior to milling is essential if the best product is to be obtained. A.B.S.

Improved technique for making thinned polished sections. KALERVO RANKAMA. *Econ. Geol.*, **36,** 561–63 (1941); *Chem. Abs.*, **35,** 6539 (1941).

Kenya's mineral resources. ANON. *Chem. Age* [London], **48** [1246] 537 (1943).—A company is being formed for the more intensive development of the mica deposits in the Sultan Hamud area, and the cutting and grading of mica for the market will be undertaken. A comparatively large output of good uniform mica should be assured from this source. At Tsavo, about 130 miles from Mombasa, a concession has been given to Kitmag, Ltd., to investigate the possibilities of a low-grade deposit of graphite. Forty miles further up the railway from Tsavo, milled asbestos is being produced by the Venture Supply Co., Ltd., at Mtoto Anedi. A new asbestos area in West Suk is to be worked by Manufactures (East Africa), Ltd. Talc production will shortly begin in West Suk, South Kavirondo, and other parts of the Colony. Kyanite is being mined and used in the local manufacture of high-temperature firebrick. Bentonite occurs in the Athi River and Timau areas. It is widely employed in the bleaching and clarification of vegetable and mineral oils and, if found suitable, would be a new development of value to the country, especially if export to oil-producing areas in the Persian Gulf could be established. A.B.S.

Metric grade scale for sedimentary rocks. H. L. ALLING. *Jour. Geol.*, **51** [4] 259–69 (1943).—A scale is proposed for the more precise designation of the size grade of constituents in thin sections of sedimentary rocks. Aggregate terms in the scale are as follows: colloidstone, 0.0001 to 0.001 mm.; claystone, 0.001 to 0.01 mm.; siltstone, 0.01 to 0.10 mm.; sandstone, 0.10 to 1.0 mm.; gravelstone, 1.0 to 10.0 mm.; cobblestone, 10 to 100 mm.; boulderstone, 100 to 1000 mm. Each grade is subdivided into very fine, fine, medium, and coarse. A.C.B.

Petrographic study of domestic talcs. LOUIS H. BERKELHAMER. *Bull. Amer. Ceram. Soc.*, **22** [7] 227–30 (1943).—2 references, 3 figures.

Sorption of NH_3 on montmorillonitic clay. I. CORNET. *Jour. Chem. Phys.*, **11** [5] 217–26 (1943).—Various dry minerals were permitted to react with anhydrous ammonia under controlled conditions. When the pressures of ammonia prevailing in the sorbing system were plotted against the quantity of ammonia sorbed, typically parabolic or hyperbolic sorption isotherms were obtained with ammonium bentonite, potassium bentonite, and finely ground hydrogen bentonite. Unground hydrogen bentonite gave a complex ammonia sorption curve in which there was a short parabolic section initially, followed by an inflection and finally a second parabolic or hyperbolic sorption section. Concurrent X-ray studies indicated that the inflection and subsequent portion of the sorption curve were accompanied by widening of the *c*-axis spacing. The sorption and concomitant X-ray data permitted the view that the sorption of ammonia by unground hydrogen montmorillonite occurred on exterior planar surfaces, interplanar surfaces, broken bonds, corners, and edges. Data on the thermal decomposition of ammonium bentonite were consistent with this view. It was found that sorbed ammonia occupied base-exchange reactive spots; physical trapping of ammonia molecules in the interplanes would not account for the lattice expansion. The data also appeared consistent with the theory that both lattice hydroxyl ions and polarization of water molecules may give rise to base-exchange capacity on grinding some clay minerals. G.A.K.

Spectroscopic studies of base-exchange materials. A. M. BUSWELL AND B. F. DUDENBOSTEL. *Jour. Amer. Chem. Soc.*, **63,** 2554 (1941); abstracted in *Trans. Brit. Ceram. Soc.*, **41** [1] 1A (1942).—From the results of infrared absorption studies, the montmorillonites saturated with various cations (Ca^{++}, Mg^{++}, Li^{+}, K^{+}, Ba^{++}, H^{+}, Na^{+}, and NH_4^{+}) are placed in four classes with respect to water uptake. The first class, of extreme absorption, consists of the Ca^{++} and Mg^{++} montmorillonites. The second, of appreciable absorption, consists of the Li^{+}, K^{+}, and Ba^{++} montmorillonites. The third class, H^{+} and Na^{+} montmorillonites, is one of slight absorption. The fourth, consisting of NH_4^{+} montmorillonite, showed almost no change on attempted hydration. Similar studies of clays of low base-exchange capacity indicate that less bonded (2.92 μ) and unbonded (2.75 μ) OH is present than in the case of the higher base-exchange montmorillonites. The assignment of the 2.75 μ band to the unbonded OH frequency is corroborated experimentally. Clays allowing replacement of structural OH by phosphate show about 25% less absorption at 2.75 μ than do unphosphated clays. The NH_4^{+} montmorillonite showed a doublet at 3.13 μ and 3.27 μ characteristic of the NH_4^{+} halides, which have a doublet at 3.20 μ and 3.30 μ. X-ray data show that the increased base-exchange capacity of greensand after heat-treatment may be due to the formation of new particles and that the artificial gel zeolites are definitely amorphous while glauconite or greensand is crystalline in structure.

Talc and vermiculite in Transvaal. ANON. *Chem. Age* [London], **48** [1241] 401 (1943).—Deposits of talc exploited in the Union of South Africa are of either the foliated or the massive variety, steatite or soapstone, and lie mainly in the Jamestown igneous complex in the Barberton district. Other deposits are worked in the Pretoria district, Verulam, and Zoutpansberg. Ground talc is used as a paper filler, and other grades are absorbed in the leather and rubber industries and in the manufacture of foundry facings. Cut soapstone products (pencils and markers used in the metalworking and tailoring trades) are produced for local use. The preliminary results of using a Transvaal anthophyllite as a substitute for American asbestine have been most encouraging and show that there is a future for this common yet important South African mineral. In eastern Transvaal, northeast of Loolkop, are large reserves of vermiculite; it occurs as large platy aggregates capable of fairly easy sorting and grading. Possibilities of developing an export trade seem favorable. See "Dressing. . . ," *Ceram. Abs.*, **20** [7] 178 (1941). A.B.S.

SEPARATE PUBLICATIONS

Clays of the Witwatersrand and Adjoining Areas: I, Refractory and semirefractory clays of the Karroo System. V. L. BOSAZZA. *Mem. Minerals Research Lab., Univ. Witwatersrand*, No. 2, pp. 3–61 (1941).—The deposits on the east and central Witwatersrand and at Vereeniging are described and discussed. The clays vary from genuine fire clays to clays suitable only for the manufacture of the poorest kinds of structural brick. The chemical and physical characteristics of the clays are considered. Numerous chemical analyses are given. Size analyses using Tyler screens down to 325-mesh are given. A modified Robinson pipette method was used for the −325-mesh portion in later work. Mineralogical composition, texture, and base-exchange properties were investigated. The refractory character of the clays is discussed, and comparisons are made with clays from other parts of the world. A system of nomenclature is suggested. **II, Nonrefractory building and pottery clays.** *Ibid.*, pp. 62–94.—These clays are also derived from the rocks of the Karroo System. **III, Additional data employing modified methods of examination.** V. L. BOSAZZA AND J. W. WILES. *Ibid.*, pp. 95–109.—Green strengths were determined, and improved green strengths were obtained by the addition of small amounts of electrolytes (sodium carbonate and silicate) and also by the addition of gum arabic. Tables of results are given. Illustrated. L.W.V.

Hard and Soft Kaolins of Georgia. T. A. KLINEFELTER, R. G. O'MEARA, G. C. TRUESDELL, AND SIDNEY GOTTLIEB. *U. S. Bur. Mines Repts. Investigations*, No. 3682, 20 pp. Free.—The report gives the results of a

joint study by the U. S. Bureau of Mines and the University of Alabama of some of the properties of the two main types of kaolin and the differences between them, for the purpose of discovering the best methods of beneficiating the hard clays to make them as usable as the soft types. R.A.H.

Manganese Investigations: 20, Ore-dressing studies of eastern manganese ores. Concentration of manganese-bearing ore from Barytes Mining Co., Cartersville, Ga. W. A. CALHOUN, T. L. JOHNSTON, M. M. FINE, AND S. M. SHELTON. *U. S. Bur. Mines Repts. Investigations*, No. 3684, 11 pp. Free. See *Ceram. Abs.*, **21** [8] 178 (1942). R.A.H.

Olivine. G. RICHARDS GWINN. *U. S. Bur. Mines Information Circ.*, No. 7239, 11 pp. Free.—G. gives a description and the occurrence of the olivine group of minerals, data on dunite, information on reserves and uses, the history and properties of forsterite refractories, and American and foreign output. A bibliography and lists of producers and buyers are included. R.A.H.

PATENT

Flotation of apatite and similar oxidic ores. K. L. RIVKIND. Russ. 57,129, May 31, 1940. 1*c*. 8.01.—As flotative for apatite and similar minerals, a mixture of fatty, naphthenic, and resinic soaps is used. M.Ho.

Chemistry and Physics

Constitution of typical adsorbers. T. SCHOON AND H. KLETTE. *Naturwissenschaften*, **29**, 652–53 (1941); *Chem. Abs.*, **36**, 1228 (1942).—Eight active charcoals, five silica gels, and three Al_2O_3 specimens were investigated with the electron microscope. Great differences could not be detected. The typical constitution is the network form of the substance. The dimensions of the crystallites are about 20 to 30 a.u.

Determination of silicic acid in aluminate solutions containing chromium and fluorine. K. A. VASIL'EV AND O. D. BARINOVA. *Zavodskaya Lab.*, **8**, 916–20 (1939); *Chem. Abs.*, **34**, 1590 (1940).—Acidify the sample with 20% H_2SO_4, heat to dissolution, and cool. If Cr is present, it should be reduced. Then add 20 to 40 ml. ammonium molybdate, dilute to 300 ml., stir, and let stand for 15 min. Add 40 ml. HCl (1:1) and an excess of a titrated 1.2% solution of 8-hydroxyquinoline, stopper, and heat for 10 min. at 60° to 70° with periodic shaking. Cool, dilute to 500 ml., and stir. Filter, discard the first portions, then to a 100-ml. portion add 50 ml. H_2O, 60 ml. HCl (1:1), and 30 ml. of 80% oxalic acid, and titrate with 0.1 *N* bromide-bromate solution in the presence of methyl red. See *Ceram. Abs.*, **22** [3] 59 (1943).

Effect on flasks of corrosion by hydrofluoric acid from phosphates used in fertilizer analysis. T. L. OGIER. *Jour. Assn. Official Agr. Chemists*, **26** [1] 196–97 (1943).—When mixed fertilizers are dissolved in acids, hydrofluoric acid is liberated. This action has a corrosive effect on the glass of the graduated flasks in which the solution is made. To determine the extent of corrosion, nineteen 200-ml. flasks that had been used in the determination of total phosphoric acid were selected for testing. The results of the tests showed that 5 of the 19 flasks had been etched beyond the tolerance of ±0.20 ml. in a ±200-ml. flask. G.A.K.

Equilibrium in the replacement of metals in solutions of fused silicates. Lead and thallium and their silicates. MARC FOËX. *Compt. Rend.*, **212**, 607–609 (1941); *Chem. Abs.*, **36**, 316 (1942).—The equilibrium $2Tl^+ + Pb = Pb^{++} + 2Tl$ was investigated between metal and silicate phases in quartz vessels in a N_2 atmosphere at 900°. Equilibrium is attained after 40 min. to 1 hr., when both phases contain both metals in the same equilibrium state regardless of the choice of original materials (Pb + Tl silicate or Tl + Pb silicate) in ratios of Pb:Tl of 17:1 to 1:4. With increasing amounts of SiO_2, the metallic phase becomes relatively richer in Pb, especially for SiO_2:Mo ratios less than 1. The Pb-Tl alloys are homogeneous and nonvolatile. The Pb–Bi–B_2O_3 system shows a similar behavior.

Investigations of the adsorption process. T. SCHOON AND H. KLETTE. *Naturwissenschaften*, **29**, 653–54 (1941); *Chem. Abs.*, **36**, 1228 (1942).—The adsorption isothermal curve of H_2 on active charcoal, silica gel, Al_2O_3, and Pt asbestos was determined, and the stairlike form was verified. A possible explanation of these facts is given.

Measurement of contact angles. ALLAN FERGUSON. *Proc. Phys. Soc.* [London], **53**, 554–65 (1941); *Chem. Abs.*, **36**, 14 (1942).—The determination of the contact angles of liquids and surfaces is critically examined. This is of practical importance in the flotation of ores. Unless special care is taken, contamination will vitiate the results. The work of adhesion and the spreading coefficient involve the contact angle also. Various methods which have been used to measure the angle of contact are summarized. The distinction between the values for advancing and retreating menisci is important. The method of the large bubble and the sessile drop is examined in detail, and other reliable methods are discussed.

Mechanism of insulation breakdown. T. F. WALL. *Engineering*, **155** [4029] 261–62 (1943).—The breakdown of solid insulating materials can be accounted for by the conduction of electricity through a multitude of minute channels in the body of the material which are filled with moisture and thus provide electrolytic conduction paths for the current. The boundary walls of the conducting channels are lined with adsorbed boundary ions which may be either positive or negative and are held in position by intensely powerful forces requiring a correspondingly intense applied electric field to tear them away. In addition to the boundary ions, supplementary ions are also attached to the boundary walls and electrically neutralize the boundary ions. The supplementary ions can be driven away by a much less intense applied electric field. In the conducting channels are the normal dissociated ions of the electrolytic moisture by which the insulation current is carried. Mathematical formulas are given. G.A.K.

More rapid determination of aluminum oxide in aluminous and aluminosilicate cements. V. T. ILLIMINSKAYA. *Zavodskaya Lab.*, No. 3, pp. 300–304 (1940); *Light Metals*, **2** [12] 185 (1940); *Bldg. Sci. Abs.*, **14** [2] 21 (1941).—Details are given of a variation in the oxyquinoline method for determining aluminum oxide in cements whereby the removal of both the silica and the iron oxide is dispensed with, thus reducing the time required for an estimation to 40 to 50 min. The combined iron and aluminum oxyquinolate precipitate is dissolved in hydrochloric acid, and the iron is prevented from interfering with the bromide-bromate titration by an addition of oxalic acid with which it forms a complex. The iron is then determined by any suitable method, and the aluminum oxide is obtained by difference.

Photocolorimetric determination of silicic acid in aluminate solutions. K. A. VASIL'EV AND E. L. ZAKHAROV. *Zavodskaya Lab.*, **10**, 143–45 (1941); *Chem. Abs.*, **35**, 5063 (1941).—Acidify 10 ml. of the aluminate solution with 30% H_2SO_4 and add 10 ml. acid in excess. Cool the clear solution to 18° to 20°, dilute with water to 250 ml., and withdraw two 50-ml. or two 100-ml. portions for analysis. Add 3 ml. of 30% H_2SO_4 to the 100-ml. portions or 5 ml. to the 50-ml. portions. Add 20 ml. of 10% ammonium molybdate to one of the solutions at 18° to 20°, dilute with water to 250 ml., and mix. Test the sample in a photocolorimeter by comparison and determine the result from a calibration curve. An analysis requires 30 to 35 min., and the intensity of coloration should be measured immediately or not later than 30 min after the addition of the molybdate.

Rapid volumetric determination of aluminum. V. A. CHERNOV AND N. S. NEKRASOV. *Zavodskaya Lab.*, **10**, 375–76 (1941); *Chem. Abs.*, **35**, 7312–13 (1941).—Place

the test solution in a centrifuge tube (70 to 75 ml.), add a few drops of bromothymol blue, and gradually add NH_3 until the indicator changes to a bluish color. Centrifuge for 1.5 to 2 min. at 1500 to 2000 r.p.m. Decant the supernatant solution, wash the precipitate 2 to 3 times with water to remove excess NH_3, and centrifuge each time and decant off the liquid. Add a carefully measured volume of HCl to dissolve the precipitate and a solution of NaF. Titrate the excess acid with NaOH to a phenolphthalein end point. The method requires 10 to 15 min., and the accuracy is satisfactory.

Reactions in solid state: III, Reaction between sodium carbonate and quartz. GEORGE GIBSON AND ROLAND WARD. *Jour. Amer. Ceram. Soc.*, **26** [7] 239–46 (1943).—9 references, 5 figures.

Report of Committee on Research. A. A. WELLS, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [7] 235–44 (1943).—33 references.

***Representing the stability of colloidal systems by isochrones and some observations on SiO_2 sols.** ALFRED DOBROWSKY. *Kolloid. Z.*, **97** [1] 80–87 (1941).—If a new substance is added to a sol consisting of two components, the stability of the sol can be graphically represented in a triangular coordinate system. By connecting the points indicating the same stability, i.e., the same span of life of the sol, lines which D. calls isochrones are obtained. For plotting it is preferable to use log t instead of t. D. investigated the system Na_2SiO_3–acid–H_2O. The acids used were HCl, H_2SO_4, H_3PO_4, succinic acid, tartaric acid, and β-naphthalenesulfonic acid. There was a proportionality between the drop in the pH of the system and the change in stability. The isochrones all crowded the place where the titration curve was steepest. By connecting the maxima on all the isochrones a tachydrome is obtained connecting the shortest life spans of the sols. For monobasic acids the tachydrome is a straight line; for polybasic acids it is a curve. High concentrations of a large anion, such as that of β-naphthalenesulfonic acid, renders the silica sol more unstable than another acid at a similar concentration. D. attributes the discrepancy with the results of other investigators to the fact that the limits of concentrations which they used were too narrow. M.HO.

Study of literature on separation of magnesia from lime in dolomite and similar materials. Compiled by GILBERT E. SEIL AND STAFF. *Jour. Amer. Ceram. Soc.*, **26** [7] 218–38 (1943).—461 references.

***Viscosity and structure of hydrophilic colloids: I.** C. ROSSI. *Kolloid. Z.*, **97** [2] 129–35 (1941).—The internal friction of 2, 3, 4, and 5% bentonite suspensions was measured with an apparatus having rotating cylinders according to Couette. The velocity of the outer cylinder was varied. Each time before taking the measurement enough time was allowed for equilibrium to be reached. All the investigated suspensions had a pronounced friction hysteresis which increased with dilution. The effect of the velocity on the friction coefficient is considerable. At the higher concentrations the results are reproducible, and the friction hysteresis does not interfere with exact determination of the internal friction. Interesting conclusions can be drawn from these observations as to the thixotropy and structure of these systems. At lower concentrations, however, the time required for establishing equilibrium is so long that the taking of measurements is almost impossible. Of special interest are the measurements taken at rapid changes of velocity, from which R. feels justified in concluding that when the liquid is kept continually in motion at varying velocities a viscosity equilibrium is also attained. The difference which exists between the friction hysteresis (or thixotropy, rheopaxy, etc., as well) and the change in friction with velocity disappears. Whereas thixotropy depends on the slow formation of an internal structure, the change in friction is independent of the building or breaking down of the structure, although friction itself may be occasioned by structure. The change in friction is apparently of a purely hydrodynamic nature. **II.** *Ibid.*, [3] 304–13.—Using the same apparatus, R. investigated the internal friction of emulsions of paraffine oils and of commercial emulsions of bitumen. The effects of pH, degree of dispersion, and concentration on the average coefficient of friction were investigated. In all cases considerable differences were observed at low velocities. The difference diminished rapidly, however, as the velocity increased. Hypotheses of the structure of the emulsions and of the bentonite suspensions are discussed. The structures of the two are quite similar. There is a basic equation underlying these structures, $K = S(\eta_\infty - \eta_\alpha)$ in which η_α is the coefficient of friction of the dispersing medium (in case of water $\eta_\alpha = 0.01$), S is a constant, and η_∞ is that part of the viscosity which is attributed to the normal intermolecular forces of the liquid. This is well borne out by the curves drawn from the experimental results. These curves enable the calculation of η_∞ for high velocities as well as K. The latter is determined by the forces which govern the water molecules surrounding the dispersed particles. M.HO.

* Obtained from microfilm.

ERRATUM

Constitution of sodium silicate solutions. R. C. RAY, P. B. GANGULY, AND A. B. LAL. *Trans. Faraday Soc.*, **38,** 104–108 (1942); reference published incorrectly as *ibid.*, **37,** 104 (1941) in *Ceram. Abs.*, **22** [1] 21 (1943).

SEPARATE PUBLICATION

Syllabus of Clay Testing: I. THERON A. KLINEFELTER, ROBERT G. O'MEARA, SIDNEY GOTTLIEB, AND GLENN C. TRUESDELL. *U. S. Bur. Mines Bull.*, No. 451. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price 15¢.—This qualitative syllabus makes available information from a single source on the evaluation of clays for both ceramic and nonceramic uses. To make the outline as widely serviceable as possible, only those tests are included that are possible in a laboratory moderately well equipped for making physical and chemical tests. In the series presented, the main and final classification is on the basis of use. R.A.H.

PATENTS

Chlorination of titanium-bearing materials. F. J. CLEVELAND (Pittsburgh Plate Glass Co.). Brit. 553,056, May 19, 1943 (March 7, 1941).

Luminescent material and method of preparing it. W. P. TOORKS (Sylvania Electric Products, Inc.). U. S. 2,323,284, June 29, 1943 (Nov. 1, 1941).—The method of preparing a luminescent material comprising mixing an alkaline-earth fluoride, a uranium-oxygen compound, and an oxide of the earth metals and firing them.

Manufacture of titanium pigments. NATIONAL TITANIUM PIGMENTS, LTD., AND A. N. C. BENNETT. Brit. 553,135, and 553,136, May 19, 1943 (Oct. 6, 1941).

Titanium pigments from sphene. A. M. BRUSILOVSKII, M. A. SHTERN, AND I. I. PANKOVA. Russ. 57,165, May 31, 1940. 22*f*. 7.—A mixture of sphene crude or its concentrate and NaCl is treated at 900° to 1000° with superheated steam. The HCl which evolves is collected. The product from the steam treatment is leached with water and then treated with dilute HCl derived from the HCl collected in the first step of the process. The solid residue is either calcined and used as pigment or processed in the usual manner to yield TiO_2. M.HO.

General

Belt-selection chart. W. F. SCHAPHORST. *Chem. Industries*, **52** [5] 615 (1943).—This chart is designed for modern short center belt drives with the motor mounted on a pivot base and depends on the fact that the diameter of the smaller pulley has much to do with the belt width required to transmit a given horsepower. A nomogram gives the relationship between the diameter of the small pulley, belt speed, horsepower to be transmitted, and belt

width. The chart is said to be safe for all short center drives that are practicable and for all pulley ratios up to 6 to 1. See *Ceram. Abs.*, **22** [6] 103–104 (1943). E.D.M.

George Herbert Brown. EMMA L. NAWROT. *Bull. Amer. Ceram. Soc.*, **22** [7] 211–14 (1943).—1 photograph.

Developments in electrical precipitation in steel plants. C. W. HEDBERG AND L. M. ROBERTS. *Iron & Steel Engr.*, **17,** 18–27 (July, 1940).—The authors discuss the general principles and history of electrical precipitation and describe its use in various processes in steel manufacture including the cleaning of blast-furnace gas, ferromanganese gas, and high-silicon iron furnaces and in detarring coke-oven gas. A special application in cleaning coke-oven gas under high pressure is described. In each case the problems involved and their solution are discussed. F.S.M.

Discussion at Board of Trustees meeting on war status of ceramic engineers. *Bull. Amer. Ceram. Soc.*, **22** [7] 231–35 (1943).—3 references.

Industrial hygiene surveys have many benefits. JOHN F. MCMAHON. *Foundry,* Feb., 1941.—An industrial hygiene survey of a plant discloses the presence or absence of potential hazards to the health of workmen. A competent industrial hygiene engineer can suggest remedies for correction, such as the installation of adequate exhaust equipment. A company that does not know its hazards or does not know positively that its operations are free from health hazards is like a company that does not know its costs. See "How . . .," *Ceram. Abs.*, **22** [1] 25 (1943). F.G.H.

Installing suction-pump piping. W. F. SCHAPHORST. *Chem. Industries*, **52** [4] 480 (1943).—No point in the piping should be higher than the level of the pump; the slope to the pump should always be upward. If this is impossible, a tee and a plug should be inserted at the maximum point. No part of the pipe should be higher than the pump cylinder; otherwise, air will collect here. On suction lines over 100 ft. in length it is essential to use an extra vacuum chamber to relieve the suction valves and to guard against water hammer. Illustrated. E.D.M.

Shall research be socialized? ANON. *Bull. Amer. Ceram. Soc.*, **22** [7] 260–61 (1943).

Silicosis: new attack. ANON. *Chem. Age* [London], **48** [1238] 324 (1943).—A new attempt to check silicosis in the ceramic industries by eliminating the actual sources of the dust is urged. Recommendations include the provision of a certificate by the Chief Inspector of Factories before any construction or reconstruction work is started, the formulation of a code of regulations in which workers and employers should cooperate, and the adoption of automatic dust conveyance. A.B.S.

PATENT

Method of producing ceramic bodies. W. L. C. VAN ZWET (vested in the Alien Property Custodian). U. S. 2,322,179, June 15, 1943 (July 2, 1941).

Any Spare Time?

. . . We Need Abstracters

The following periodicals are at present unassigned. An abstracter for any of these should have the periodical available and be prepared to submit abstracts regularly each month. Address all requests for assignments to the office of *Ceramic Abstracts*, 2525 N. High St., Columbus, Ohio.

American Builder
American Gas Assn. Monthly
American Gas Assn. Proceedings
American Journal of Archaeology
American Journal of Pharmacy
American Journal of Surgery
American Standards
Anales de la Asociación Química Argentina
Anales de Física y Química [Spain]
Anales de la Sociedad Cientifica Argentina
Antiques
Archives of Dermatology and Syphilology
Arkansas Geological Survey Bulletin
Arts and Decoration

Building Standards
Brick Builder
British Clayworker
British Dental Journal
Brit. Elec. & Allied Inds. Research Assn. Rept.
Bulletin of the Air Hygiene Foundation
Bulletin of the Institute of Sanitary Engineers
Bulletin of the Institution of Mining and Metallurgy
Bulletin of the National Research Council

California Journal of Mines and Geology
Canadian Machinery
Canadian Medical Assn. Journal
Canadian Public Health Journal
Cement, Lime & Gravel
Cement and Lime Manufacture
Chemical Bulletin
Chemist
China, Glass & Lamps
Concrete and Constructional Engineering
Connoisseur

Electric Journal

(*Continued on page 148*)

(*Continued from page 147*)

Electrical Review
Electrical Times

Food Industries
Food Manufacture
Fuel Economy Review

Geological Survey of Ohio Information Circular
Geological Survey of Wyoming Bulletin

Heating, Piping and Air Conditioning
Heating & Ventilating
Heating and Ventilating Engineer
Heat Treating & Forging
House Beautiful
House & Garden

Illinois Medical Journal
Illustrated London News
Industrial Finishing
Industrial Marketing
Instituto de Pesquisas Technológicas, São Paulo, Brasil, Boletim

Journal of the American Dental Assn.
Journal of Biological Chemistry
Journal of the British Archaeological Assn.
Journal of Hygiene
Journal of the Institute of Heating & Ventilating Engineers [London]
Journal of the Institution of Production Engineers
Journal of the Royal Technical College [Glasgow]
Journal of the South African Chemical Institute

Machinery [London]
Master Builder
Mechanical Handling
Mechanical World and Engineering Record
Metal Treatment
Manufacturers' Record
Mine & Quarry Engineering
Mining Journal [London]
Mining Journal [Phoenix]
Mining and Metallurgical Society of America Bulletin
Modern Machine Shop
Modern Power & Engineering
Monthly Review of the American Electroplaters' Society

National Engineer
National Safety News
New England Journal of Medicine

Ohio Industrial Commission Monitor
Optician

Penna. Dept. Labor & Ind., Safe Practice Bull
Pennsylvania Medical Journal
Pit and Quarry
Pottery and Glass Salesman
Power and Works Engineer
Proceedings of the American Society of Civil Engineers
Proceedings Chem. Eng. Group, Soc. Chem. Ind.
Proceedings of the Cleveland Institution of Engineers [England]
Proceedings of the Institute of British Foundrymen
Proceedings of the Institute of Vitreous Enamellers
Proceedings of the Iowa Academy of Science
Proceedings of the National Smoke Abatement Society, Annual Conference
Proceedings of the Royal Institution of Great Britain
Proceedings of the Staffordshire Iron and Steel Inst.

Radiology
Revista de Química Industrial [Rio de Janeiro]

Safety Engineering
Sheet Metal Industries
Stained Glass

Times Literary Supplement
Trans. Inst. Mining & Metallurgy

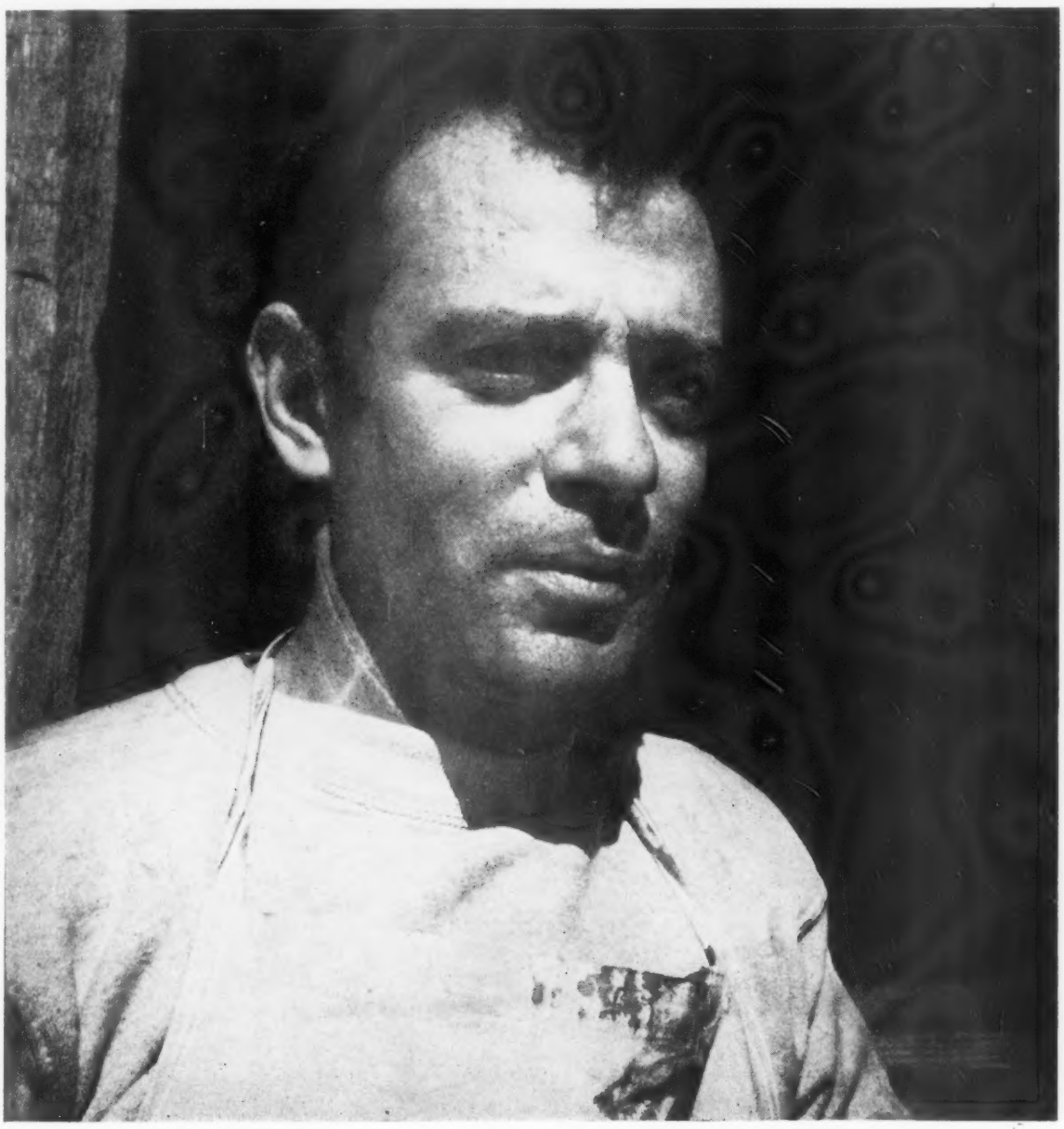
U. S. Dept. Labor, Div. Labor Standards, Bulletin

Welder
Welding Industry [London]
Welding Journal [London]

THE AMERICAN CERAMIC SOCIETY, INC.
2525 N. High St. Columbus, Ohio

THE BULLETIN SECTION

Volume 22 August 15, 1943 Number 8



EDWIN SCHEIER

EDWIN AND MARY SCHEIER

Mr. and Mrs. Edwin Scheier have individualities, personal charm, artistic abilities, creative originality, and untiring ambition to be of service to others. They are happy and buoyant and yet are serious in their efforts to achieve success as artists. Although rejected repeatedly by the Army and Navy for war service and having a deferred classification, Edwin Scheier persisted until a place was found in the Army Air Corps where he could employ his special talents. Thus, from an interesting and lucrative position as ceramic art instructor at the University of New Hampshire, Edwin chose to go into the armed forces. The following brief sketch of the activities and character of these two young people shows what it takes to make life worth living.

Edwin's parents were born and educated in Germany. They were married in America in 1885 and were naturalized. Edwin's father was an importer. Two children, a daughter and a son, blessed this union. The father died in 1910 just after Edwin, the son, was born. This fatherless family continued together until Edwin was eighteen and was graduated from high school. Edwin then "went on his own."

He entered the New York School of Industrial Arts and continued his studies at this school for two years. He spent the summer months as a merchant seaman, which work gave him contacts abroad. Intrigued with the art of tattooing, he practiced it whenever and wherever opportunity was afforded. Many of his pottery decorations show the influence of his practice in tattooing.

While attending the New York School of Industrial Arts, Edwin audited courses, with no credit accruing, at Columbia University. During these two years, and for a while after, Edwin made his living as an independent craftsman and, incidentally, made a reputation for such skill and originality that he was offered a position with the Federal Art Project, a position which he accepted. He was sent down south as Field Supervisor of Crafts for the southern states. In due time, this brought Edwin to the Big Stone Gap Federal Art Gallery, of which Mary Goldsmith was Director.

This, it is said, was not the first time that Edwin and Mary had met. It is reported that they first met in a New York museum while each was admiring some old Chinese red vases. Walking in different directions around the case in which these vases were placed, they bumped into each other. They stopped mutually to admire the vases and left admiring each other: love at first sight in a museum. It was in an art gallery that they again met, this time not to be separated until Edwin joined the service. Edwin and Mary were married shortly after he met her at the Big Stone Gap Federal Art Building in Virginia.

Thus briefly is traced the life of Edwin from his birth in New York City, November 11, 1910, until August 19, 1937—twenty-seven years. Edwin was, at twenty-seven years of age, embarked upon a fruitful life and was aided by a helpmate who was equally as resourceful and just as desirous to earn a living by engaging in independent creative enterprises. Neither of them enjoys being employed or being "beholden" for their livelihood to any concern or person.

Mary Scheier

Mary, the lady member of this Scheier team, was the seventh child and the youngest daughter in a family of nine children—five girls and four boys. Her parents were native Virginians and descendants from English families: James Skinker Goldsmith and Mira Livingston Hamersley. All of these nine children, except Mary, were graduated from college, and each is successful. One brother is a lawyer, one an engineer, and two are businessmen. Four of the five sisters are homemakers, each with a growing family. Mary, the fifth daughter, is the exception. She did not go to college, is not devoting her time to homemaking, and has no children. She, like her husky "All-American" football brothers, is large and very robust in mind and body.

She was born May 9, 1910, at the five-acre homestead in Salem, Virginia. There the family had horses, cows, pigs, chickens, orchard, and garden. The mother was an accomplished musician; indeed, she often played the

organ at church services. After being graduated from Lynchburg Seminary, Mary's mother taught music until she joined Mr. Goldsmith in marriage.

James S. Goldsmith, Mary's father, was president of the Sunday School, and the entire family attended regularly. Both parents had deep religious convictions and sincere faith but never tried to impose it upon others, with the result that all nine of the Goldsmith children have continued in the religious faith and practices of their parents.

Mary Scheier

Mary says that naturally they all were Democrats. Her father was a Town Councilman and worked for better living conditions for the Negroes. He was a real Liberal but a thrifty one.

Mary's father was express agent for the Norfolk and Western Railroad and was stationed until 1926 in Salem. He later moved southwest down the road to Christiansburg, where he continued with the railroad until he died. Those were the days of large express commissions, and father Goldsmith was popular and influential, a fact which explains why he could afford to send eight of his children through college and his daughter Mary to the New York School of Fine and Applied Arts after her graduation from the Salem High School at the age of sixteen.

Mary was in the New York School two years (1928 and 1929) and then spent one year at the Paris branch of this School.

Returning from Paris, Mary devoted one year to advertising in New York City for the Burgoyne Hamilton Real Estate Agency and one year as a stenographer in Christiansburg, Virginia.

It was in 1935 that Mary went to the Big Stone Gap Federal Art Gallery as Director, and it was in August, 1937, that Edwin and she were married. Both Edwin and Mary immediately resigned their respective art supervision jobs and started on their way as traveling puppeteers down south. What fun, and such a delightful ending. They modeled the heads, designed the costumes, and wrote the plays.

Mary was an average high school girl, cultured in music and literature, but without a hobby. Edwin, on the other hand, in addition to being cultured, was always a modeler and storyteller. His stories, generally on himself, are witty and always with action. He translated into modeled forms his wit as well as fabled stories of his own and of literature. His grotesque modeling of Androcles and the lion in Parian is a prized addition to the ceramic exhibit at the headquarters of The American Ceramic Society. Their puppets and their plays were "screams." Their puppeting enterprise was a success. It led the way to a Federal Art Project in Norris, Tennessee, where they taught art in metal, wood, and leather, also drawing and painting.

The names of some of the puppets were "Butch," "Mrs. Dripping Gold," "Chief Worry Wart," "Mrs. Murphy and Professor Kookoo," and "Mae West." Several monkeys, doctors, devils, crying babies, and clowns were among the dozens of puppets.

Mary and Edwin, with the puppets in a delivery truck, toured the south for several months. That was a gay crew. They were hauled into court for holding a show on a street corner and obstructing traffic. They gave a puppet show for the judge and so enchanted was he that the charge was forgotten and a set of puppets purchased.

One little girl was so captivated by the clown with red hair that she followed the show to the next town and would consent to go home only when they gave her the puppet.

Mary and Edwin were having fun and earning a living. They proved that a traveling troupe could be as successful in this day as they were many decades ago. Their itinerary led them to Norris, and here one day Hewitt Wilson called on them and suggested that they also work in clay. They tried it and were fascinated. Thus it was that they became potters, but not before they had devoted six months to practice and study.

Androcles and the Lion

Dr. Wilson invited them to visit the TVA Ceramic Laboratory. There they found potters skilled in the several pottery arts. Mary found that, for her, turning a vase on the potter's wheel was easy. At the potter's wheel she was like a duckling in water—just natural. And for Edwin the plastic clay was the most fascinating modeling medium with which he had worked. Mary and Edwin had found new tools with which they could translate their brain children into forms wanted and needed by others.

In return for the instruction they received from Dr. Wilson and other members of the Laboratory staff, Edwin and Mary tended the kiln nights and rendered other services. With acquired skill and a collection of glaze and stain formulas with which they had practiced and which they had proved, the Scheiers again pulled stakes. No doubt they started for Mary's home in Christiansburg; this, only six months after the chance call on them by Dr. Wilson.

The Scheiers at Glade Spring, Virginia

"A young couple driving through this section of Southwest Virginia had the good luck—yes, good luck—to have a flat tire near Glade Spring. The edges of the road were wet and muddy and the man, while fixing the tire, got much of the clay on his clothes. Later, when trying to remove the clay, he made a discovery. The ordinary-looking red clay had a consistency ideal for making pottery. Dreams of a pottery plant at that spot and the making of pottery from the native clay sprang into the minds of the couple!" [1]

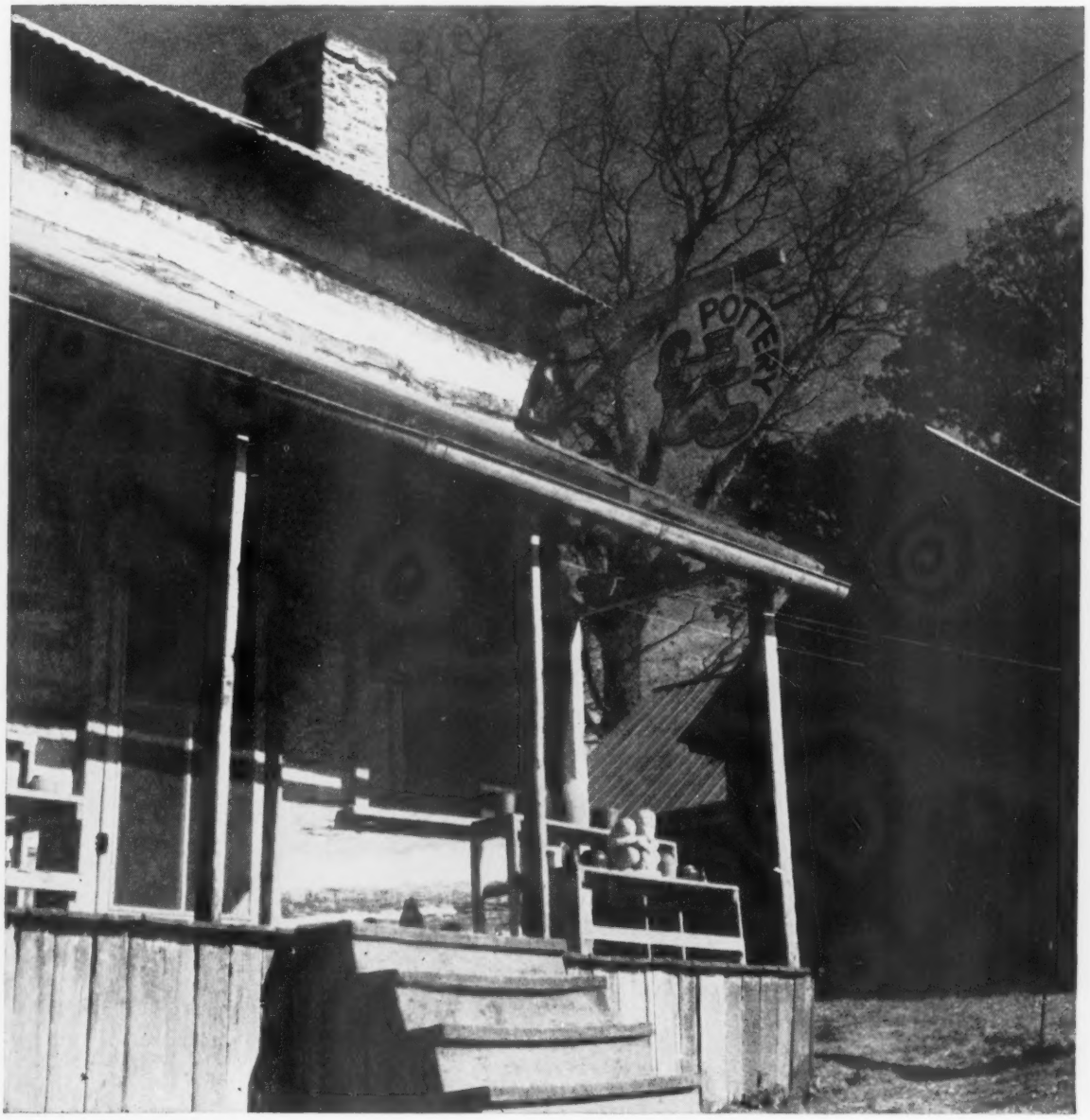
Edwin and Mary rented a shack, built a ground-hog kiln, and made their equipment. Sewing machines and

Edwin loading the Glade Spring kiln

parts from a Ford were used for wheels, mills, screens and power. From the beginning of this venture they supported themselves on the pottery sold. Some of the

[1] *The Roanoke Times*, November 26, 1939.

Showroom at Glade Spring, Virginia. Their first pots.



In foreground, the Glade Spring House, their first pottery venture; to the right, the workshop, formerly an old country store.

pieces made during the first year were shown in the contemporary Industrial Arts Exhibit at the New York Metropolitan Museum, two pieces were awarded second prize at the National Ceramic Exhibition at the Syracuse (N. Y.) Museum, and nine pieces were awarded first prize in the Western Hemisphere Exhibit in Syracuse.

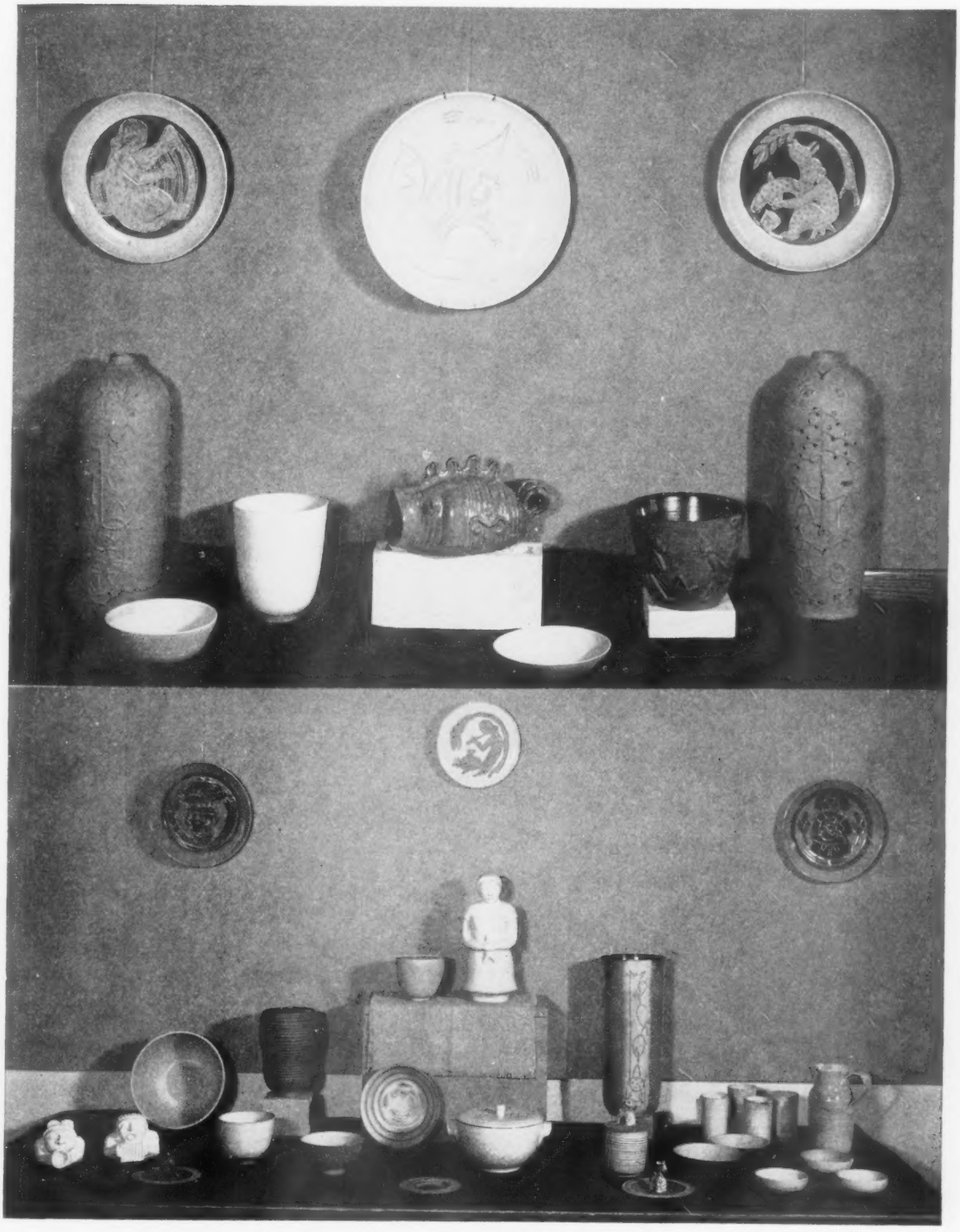
When Robert Porterfield, of the Barter Theater, went shopping for a trophy to present to Laurette Taylor for her performance as Mrs. Midget in "Outward Bound," he chose a small figure which he found in a New York shop called "The Washerwomen." He also chose two small figures called "The Square Dancers" to give to Mrs. F. D. Roosevelt, who presented the award to Miss Taylor. These figures had been made by the Scheiers at their Glade Spring pottery.

Out of salvaged scraps, in a hut hardly habitable, with only six months' experience, these young people embarked on a roadside ceramic craft enterprise and succeeded. For food and furniture they bartered with the native children and grownups who also wanted to fashion things by hand from clay. They came to see what all this "foolishness" was about, bringing vegetables, preserves, and fruit. "Before long, every young person in the community was coming to Hillcrock for part of the day. When they weren't learning how to prepare the clay and to model, they were carrying wood for the kiln, digging clay—doing anything so the Scheiers would let them stay around."[2]

In less than a year after their flat-tire stop at Glade Spring, the Scheiers attended the conference of the Art

[2] *Richmond Times-Dispatch*, October 22, 1939.

Durham Exhibit, November, 1942



Durham Exhibit, November, 1942

Division of The American Ceramic Society at Black Mountain, North Carolina. They financed this trip by sales of their own ware. They sold a bushel of miniature pitchers and a large drove of clay pigs to Clementine Douglas, Director of the "Spinning Wheel," a handicraft shop near Asheville, North Carolina. In one day, Mary could fashion on her throwing wheel over two hundred of these little pitchers glazed and once fired.

Edwin made "pigs of various sizes with garlands of flowers around their necks and occasionally flowers dropped upon their backs quite in contrast to the sturdiness of the pigs themselves, with expressions upon their faces ranging from the highest glee to the depth of melancholy, and a few satirical-looking ones sticking their noses forward."[1]

At the end of the first year after setting up shop at Glade Spring, they were asked, through the League of New Hampshire Arts and Crafts, to teach ceramics at the University of New Hampshire. So again they loaded the Ford truck and this time trekked to Durham, New Hampshire. Within eighteen months after they had met Hewitt Wilson at the TVA Laboratories at Norris, Tennessee, they were ceramic instructors in the Department of Fine Arts of a New England university. They took to Durham their homemade pottery equipment and much of their stock of vases and figures. They had created prize-winning artware, had built all of their equipment, had fed and clothed themselves, and had made journeys to craft and commercial potteries—all within eighteen months.

Pottery class at the University of New Hampshire

Mary and Edwin loading their electric kiln, an adaptation of the Norton (M.I.T.) kiln.

Durham Exhibit, November, 1942

At the end of another year, the pottery laboratories at the University of New Hampshire moved into larger quarters. They now have electric kilns, modern equipment, and a large class of enthusiastic boy and girl students, but that first year as university instructors was not comparable in pleasure to the year in which they built themselves a pottery in a shack at Glade Spring, Virginia.

FEAR AND WANT

THE EARLIEST AND THE PRESENT-DAY RELIGIONS
ALL HAVE HAD AND CONTINUE TO HAVE
THEIR FUNDAMENTAL CONCEPTS BASED ON
FEAR OF GOD AND WANT OF A SAVIOUR

ACTIVITIES OF THE SOCIETY

TO MEMBERS OF THE DIVISION OF CERAMIC DESIGN

A Letter from the Chairman

June 4, 1943

At the Pittsburgh meeting of The American Ceramic Society, it was agreed by the Board of Trustees and a number of the members of the Art Division to change the name to the "Division of Ceramic Design."* The word "Art" was too broad a term; the Division had no working plan; there was too much concentration in the past; papers that were of interest to the studio potter and the group of folk who made pottery a hobby and the industry, as a whole, were neglected.

The real reason for this lies in the fact that we lack a membership in the Division of the industrial designer, the men who contact the designer for industry, and a large number who have a general interest in promoting the sale of ceramic products through design.

President Bales has appointed a Committee from the Glass, Enamel, White Wares, and the Structural Clay Products Divisions to work with us, and the chief function of this Committee will be to contact those in their respective industry who, it is hoped, will support this Division.

With an increased interest in the Division of Ceramic Design, it is the desire to work out a plan whereby some of the papers that would be of special interest to the Glass, Enamel, and White Wares Division could be presented to that group at the Annual Meeting. In this way, we could acquaint the technologist with the designers' aims.

We hope in this way to explore the possibilities of building a program that will fit the needs of industry. Papers of special merit should be reprinted and circulated by the industry, thus fostering a better understanding of the broad field of ceramics.

This Division of Ceramic Design could cooperate with a Public Relation Committee. Many papers in the past have a direct public appeal; more of this type should be encouraged.

With the growth of the Division, plans should be made toward the formation of an Institute of Ceramic Design. We must have a wider interest with a larger membership before we are entitled to this privilege.

With the return to normal times, we should continue to hold summer meetings to hold the interest of a large number of teachers and the craft potter. We must hold the present membership of this group and do all we can to enlarge it. We have had successful meetings in the past. Many of the members are unable to attend the Annual Meetings of The Society; the country, therefore, must be divided and a setup that would fit the needs of this group should be worked out.

Suggestions have been made that we give some thought to a certificate of merit to be given to outstanding designers and architects through a special committee of local members at each Meeting city, as a public relation gesture. We need publicity, and this suggestion has merit in the right direction.

The forming of discussion groups, for the collector of ceramic art and literature, should also have our attention. The success of the Ceramic Camera Club, as a sideline diversion, points the way.

—WALTER A. WELDON, *Chairman*

* See *Bull. Amer. Ceram. Soc.*, **22** [7] 244 (1943).

ACTION TAKEN BY REFRACTORIES DIVISION AT ANNUAL BUSINESS MEETING AT PITTSBURGH DECLARED IRREGULAR

An amendment concerning changes in Article RR VII, Nominations and Elections, was presented at the Annual Meeting. The complete Rules were published on pages 399–401 of *The Bulletin* for October, 1938.

The amendment to the Rules as presented to the Division was as follows:

Article RR VII, Nominations and Elections

(1) The retiring Chairman of the Division, the Division Trustee, and one member appointed by the Division Chairman shall constitute the Nominating Committee of the Division.

(2) Unchanged as written.

(3) The Division Nominating Committee as established in Article RR VII, Section (1) hereof, shall have for its Chairman the retiring Chairman of the Division. This Committee shall nominate a slate of candidates for the office of Division Chairman, Division Vice-Chairman, and Division Secretary-Treasurer. The Committee shall certify, etc., continue as written.

4(*a*), 4(*b*) and 4(*c*) Remain unchanged except delete the term "Executive."

5(*b*) Remains unchanged.

When the amendment was proposed, there were two changes moved to be included. The first of these was that one member be appointed by the Executive Committee instead of by the Division Chairman. This proposal was further altered by a motion that two nominees be specified for each office on the ballot. A vote was taken, and the majority voted for the amendment with the changes as noted.

After this meeting, it was discovered that the original amendment had not been presented in writing to the Division. It was in error, therefore, and the subsequent action by the Refractories Division in voting was illegal.

To make the rule change legal, the amendment will be submitted to the Division in written form and acted upon by letter ballot at a later date.

SIMPLIFIED PRACTICE RECOMMENDATION ON VITRIFIED PAVING BRICK REAFFIRMED

Simplified Practice Recommendation R1–40, Vitrified Paving Brick, which was reaffirmed without change in 1941 and 1942, has again been reaffirmed by the Permanent Committee of the industry in charge of the regular review of this program.

This recommendation, which was first proposed and developed by the industry in 1921, has, since that time, been reviewed annually and revised ten times. In its recent survey, the Committee found that 77.1% of the total shipments during the calendar year 1942 were in accordance with the five sizes shown in the Simplified Practice Recommendation.

In 1921, vitrified paving brick was available in sixty-six different stock sizes. The original recommendation reduced this variety to eleven, and the first revision conference further reduced the number to seven sizes. Subsequent conferences and surveys have resulted in a net reduction of stock sizes to five.

SURVIVAL OF THE FITTEST

This Is the Axiomatic, Inexorable Law
For Animals on Earth, Birds of Air, and Fish in Waters
Except for Those in Captivity
Each Enjoying Free Competitive Enterprise

For Food, Raiment, and Self-Preservation
Only Nitwits and Prisoners
From the Cradle to the Grave
Are Free from Worry
And Free From Want

To Fit Oneself to Survive
One Must Make Himself Strong
And Learn to Team Up With Others

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 19, 1939	1876	237	27	642	220	3002
December 20, 1940	1995	260	25	574	220	3074
December 21, 1941	2029	257	37	609	220	3152
December 21, 1942	2088	270	15	446	220	3039
January 21, 1943	2079	267	11	444	220	3021
February 21, 1943	2095	267	10	451	220	3043
March 21, 1943	1765	262	8	416	220	2671
April 21, 1943	1909	266	18	442	220	2855
May 21, 1943	1931	280	15	438	220	2884
June 21, 1943	1950	283	14	441	220	2908
July 21, 1943	1968	290	11	455	220	2944

NEW MEMBERS IN JULY

Corporation

BOTFIELD REFRACTORIES CO., A. H. Engstrom (voter), Swanson & Clymer Sts., Philadelphia, Pa.
DENISON ENGINEERING CO., W. C. Denison, Jr. (voter), 1160 Dublin Road, Columbus 16, Ohio.
DUNCAN & MILLER GLASS CO., James E. Duncan, 3d (voter), Washington, Pa.
ERIE RESISTOR CORP., Byron B. Minnium (voter), 644 West 12th St., Erie, Pa.
HARKER POTTERY CO., Robert E. Boyce (voter), East Liverpool, Ohio.
IDEAL TOOTH, INC., Martin Myerson (voter), Cambridge 39, Mass.
KIMBLE GLASS CO., M. A. Eddy (voter), Vineland, N. J.
MAURICE A. KNIGHT "KNIGHT-WARE," M. A. Knight, Jr. (voter), Box 111, Akron 9, Ohio.
PLIBRICO JOINTLESS FIREBRICK CO., W. A. Schaefer (voter), 1840 Kingsbury St., Chicago 14, Ill.
UNIVERSAL POTTERIES, INC., G. D. Agnew (voter), Cambridge, Ohio.

Personal

LAWTON, A. V., Chester, W. Va., ceramic consultant, Harker Pottery Co.
LEVI, ORMONDE S., Save Electric Corp., 615 Front St., Toledo 5, Ohio; chemist.
MARQUIS, JOHN E., 67 W. Cooke Rd., Columbus, Ohio; research associate, Engineering Experiment Sta., Ohio State University.
MOONEY, KURT M., 32 Arcadia Place, Vineland, N. J.; glass technologist, Kimble Glass Co.
MOURAUD, PAUL H., 14 Ingleside Rd., Upper Montclair, N. J.; director of research, Isolantite, Inc.
*SCHABACKER, H. E., Erie Enameling Co., 1400 West 20th St., Erie, Pa.; president.
SEELEY, E. L., Neptune Ave., Chester, W. Va.; superintendent of clay shop, Harker Pottery Co.
SHUKLE, ARCHIE A., 1613 Bennett Ave., Flint, Mich.; ceramic engineer, A C Spark Plug Co.
SMITH, WILBUR R., 2126 Kennedy St., Philadelphia, Pa.; superintendent, Delloy Metals.
SOKOLOFF, VLADIMIR P., 3265 Pine St., Riverside, Calif.; junior chemist, University of California College of Agriculture.
SPARLER, D. J., Universal Asbestos Corp., 154–12 117th St., Ozone Park, N. Y.; vice-president.
STANWORTH, JOHN E., 109 Bilton Rd., Rugby, Warwickshire, England; glass technologist, British Thomson-Houston Co., Ltd.
*STOCKDALE, VERNON B., 609 W. Meek St., Abingdon, Ill.; vice-president, Abingdon Sanitary Mfg. Co.

Student

Missouri School of Mines: MATTHEW KERPER.
University of Saskatchewan: JOHN A. PERRY.

* Indicates former member of The Society rejoining.

NORTHERN CALIFORNIA SECTION

A meeting of the Northern California Section was held June 24, 1943, at the Coit Hotel, Oakland, Calif.

The meeting was called to order by the President, W. V. Bragdon. W. V. Knowles, of the Titanium Alloy Mfg. Co., was guest speaker and addressed the group on "Ceramics, a Substitute for Metals and Plastics."

Officers for the Section for 1943 are as follows:

President: W. V. BRAGDON, California Faience Co., Berkeley, Calif.
Vice-President: B. W. WYATT, N. Clark & Sons, Alameda, Calif.
Secretary: P. C. VALENTINE, Del Monte Properties Co., San Francisco, Calif.
Treasurer: W. C. HILDEBRAND, L. H. Butcher Co., San Francisco, Calif.

—P. C. VALENTINE, *Secretary*

MEMBERSHIP WORKERS' RECORD

Corporation

C. E. Bales	2	C. T. Frazier	1
C. B. Delgado	1	J. F. Hunt	2
W. C. Denison, Jr.	1	Office	3

Personal

C. E. Bales	2	M. E. Holmes	1
R. E. Bidwell	1	J. F. Hunt	1
G. A. Bole	1	Ralston Russell, Jr.	2
J. W. Hepplewhite	2	W. E. S. Turner	1
Office	2		

Student

P. G. Herold	1	W. G. Worcester	1
		Grand Total	**25**

ROSTER CHANGES FOR JULY†

ANDERSON, RICHARD J., 4759 Fourteenth Ave., South, Minneapolis, Minn. (Little Rock, Ark.)
BESLEY, JOHN S., Wabash River Ordnance Works, Terre Haute, Ind. (Joliet, Ill.)
CHESNY, H. H., Washington Inn, Cape May, N. J. (Los Angeles, Calif.)
CLARK, JOHN D., Apt. 213, Jericho Manor, Jenkintown, Pa. (Columbus, Ohio)
FAUST, GEORGE T., Box 22, Forest Glen, Md. (Silver Spring, Md.)
GENTRY, RAYMOND, Alexander H. Kerr & Co., Inc., Santa Ana, Calif. (Muncie, Ind.)
GERBER, ALBERT C., W. A. Case & Son Mfg. Co., Robinson, Ill. (Oak Park, Ill.)
GORNALL, HENRY A., 211 Washington St., Newell, W. Va. (Cleveland, Ohio)
HAWK, ELWIN A., Route 1, East Rochester, Ohio (Canton, Ohio)
HEDDEN, WALTER A., 25 Elm St., Dalton, Mass. (Alfred, N. Y.)
HENRY, GEORGE R., 37 Neeld Lane, Green Ridge, R. D. 1, Chester, Pa. (Collingdale, Pa.)
PLANJE, CHRISTIAN W., Gladding, McBean & Co., 1275 Harrison St., San Francisco 3, Calif. (Lincoln, Calif.)
WALTON, S. F., Exolon Co., Tonawanda, N. Y. (Blasdell, N. Y.)

† Address in parentheses is former address.

AUTUMN MEETINGS, SUMMIT HOTEL
Glass Division, September 15 and 16
White Wares and Materials and Equipment Divisions, September 17 and 18

CERAMIC HISTORY

Astounding indeed are the extensive developments during the last few decades in the processing of the products of clay, glass, and vitreous enamels. This can most greatly be appreciated by historical sketches of these enterprises. These developments have been stressed in the Personal Histories which have appeared in *The Bulletin* of this Society. Special histories have been written, with accompanying photographs, of eighty-eight persons. Biographical sketches have appeared also in the news items.

The biographical sketches of Allen Percival Green and of Ernest B. Merry in the June, 1943, issue of *The Bulletin*, of George Matthew Verity in the January, 1943, issue, and of Harold Otis Bosworth in the March, 1943, issue are personal histories, reciting industrial accomplishments. In each case, emphasis has been given to the training and personal aptitudes responsible for the accomplishments made.

We should have more of such historical stories. Suggestions and the cooperation of the readers are solicited. Of whom should historical stories be obtained that will portray progress in ceramic processing?

The following are the eighty-eight feature stories which have appeared:

Edward Orton, Jr., March, 1932
Booth C. Davis, June, 1933
Adelaide Alsop Robineau, September, 1935
Ernest Mayer, February, 1936
John Peate, April, 1936
Otto Schott, May, 1936
James Pass, June, 1936
F. B. Norton, August, 1936
Amory Houghton, Jr., September, 1936
Samuel A. Weller, October, 1936
Commodore S. O. Richardson, November, 1936
Mrs. Bellamy Storer, December, 1936
William H. Bloor, January, 1937
Charles N. Brady, February, 1937
Walter Scott Lenox, April, 1937
Jacob Vollrath, May, 1937
Robert Kennedy Duncan, June, 1937
Peter McGil McBean, July, 1937
Karl Turk, Sr., August, 1937
Thomas Maddock, September, 1937
Eckardt V. Eskesen, October, 1937
W. E. Wells, December, 1937
James Tams, January, 1938
Edward Drummond Libbey, February, 1938
M. J. Owens, March, 1938
Charles Fergus Binns, April, 1938
Mary Louise McLaughlin, May, 1938
Charles L. Allen, June, 1938
Willard D. Richardson, July, 1938
Frank J. Tone, August, 1938
Theodore Ahrens, September, 1938
Karl Langenbeck, October, 1938
Julius Aron and Hermann Seger, November, 1938
H. Ries, December, 1938
Stanley G. Burt, January, 1939
Herbert A. Wheeler, February, 1939
Philip D. Armour, March, 1939
Lawrence E. Barringer, April, 1939
Ellsworth Woodward, May, 1939
Francis W. Walker, June, 1939
Captain J. B. Ford, July, 1939
Theodore Haviland, August, 1939
Frederick Carder, September, 1939
Fred M. Locke, October, 1939
Clara Chipman Newton, November, 1939
Gustav Hottinger, December, 1939
Isaac Stahl and Thomas Stahl, January, 1940
Theodore A. Randall, February, 1940
Leon J. Houze, Sr., March, 1940
Gordon C. Keith, April, 1940
O. O. Bowman and Sons, May, 1940
Moses Golding, June, 1940
Gordon Battelle, July, 1940
Lewis Paul Reese, August, 1940
Edward Ray Weidlein, September, 1940
Eugene Cornelius Sullivan, October, 1940
John A. Brashear, November, 1940
Chauncey Earl Frazier, December, 1940
Benjamin Harker, January, 1941
Edward Bausch, February, 1941
Carl George Hilgenberg, March, 1941
Walter Jodok Kohler, April, 1941
James MacMath Smith, May, 1941
Samuel P. Harbison, June, 1941
Arthur L. Day, July, 1941
John Pitcairn, August, 1941
William Lloyd Evans, September, 1941
Edward Goodrich Acheson, October, 1941
James Robertson, November, 1941
Alexander Silverman, December, 1941
Herman Mueller, January, 1942
Charles R. Hook, February, 1942
E. Wilson Heisey, March, 1942
Edward Mathews Ayers, April, 1942
Lulu Scott Backus, May, 1942
Clara Maud C. Hilton (Craft Potters in N. C.), June, 1942
Cullen Warner Parmelee, July, 1942
Isaac Watts Knowles, August, 1942
George W. Wells, September, 1942
John Goodwin, November, 1942
Frederick Hurten Rhead, December, 1942
Mildred Davis Keyser, January, 1943
Irving Wightman Colburn, February, 1943
Albert Champion, March, 1943
James Columbus Steele, April, 1943
Everett Townsend (History of Tile Industry), May, 1943
Leonard L. Denison, June, 1943
George H. Brown, July, 1943

MEMBERS IN SERVICE *

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(181) Walter East, New York State College of Ceramics, Alfred, N. Y.
(182) LeRoy Greenspan, New York State College of Ceramics, Alfred, N. Y.
(183) Chester Gulick, Kentucky-Tennessee Clay Co., Alliance, Ohio.
(184) Neil I. Kantor, Pennsylvania State College, State College, Pa.
(185) John R. Kauffman, Allied Engineering Co., Milltown, N. J.
(186) James A. Marlow, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.
(187) Malcolm A. Schweiker, Jr., Rutgers University, New Brunswick, N. J.
(188) Robert Turnbull, New York State College of Ceramics, Alfred, N. Y.
(189) L. H. Walker, Pfaudler Co., Rochester, N. Y.
(190) Charles F. Wysong, Georgia School of Technology, Atlanta, Ga.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

Division Autumn Meetings, Summit Hotel, Uniontown, Pa.

Glass—September 15 and 16 **White Wares and Materials and Equipment, September 17 and 18**

PERSONAL NOTES

Edwin M. Rupp

EDWIN M. RUPP

Chairman, Materials and Equipment Division

Edwin M. Rupp was born October 8, 1898, in Middletown, Ohio, the son of Edward C. and Margaret E. Rupp. Following graduation from Middletown High School in 1917, he attended Purdue University, Lafayette, Ind., for one year, where he was enrolled in chemical engineering. For the next three years, he attended Ohio State University, Columbus, Ohio, where in 1921 he received the B.Sc. degree in ceramic engineering.

Mr. Rupp has been associated successively with the National Fireproofing Co., Keyport, N. J.; U. S. Bureau of Mines (on Car "Holmes"); Surface Combustion Co., Toledo, Ohio; Cambridge Tile Mfg. Co., Cincinnati, Ohio; and the Square D Co., Peru, Ind. At the present time, he is associated with the National Engineering Co., Chicago, Ill.

Publications

(With G. G. Kent) "Additional Data on Stoker-Fired Tunnel Kiln," *Jour. Amer. Ceram. Soc.*, **14** [9] 640–42 (1931).

(With G. G. Kent) "Continuous vs. Periodic Filtering," *Bull. Amer. Ceram. Soc.*, **16** [10] 390–92 (1937).

"Symposium on 'Improved Processing and Control Methods for Ceramic Raw Materials': I, Controlled Mixing," *ibid.*, **18** [9] 317–18 (1939).

Patent

"Pulverizer for High-Moisture Bodies."

A NEW HEAVEN AND A NEW WORLD

Use of Incentives in Place of Directives
Results in Reduction of Product Costs
And Increase in Personal Compensation

MYRTLE MERITT FRENCH

Secretary, Design Division

Ceramists on every front are giving their time and energy to the furtherance of the war effort. Notable among workers on the home front is Myrtle Meritt French, Secretary of the Design Division and assistant professor and head of the Ceramic Division at the Art Institute of Chicago, Chicago, Ill., who is giving freely of her ceramic knowledge and skill to work with our hospitalized soldiers and sailors. In the following paragraphs she tells in her own words of the extent of her wartime ceramic activities.

"I am working with the Arts and Skills Unit of the Hospital and Recreation Corps of the Volunteer Special Services. The work is done in the Army and Navy hospitals as part of the Red Cross activities. There are three such centers: one in New York, one in Chicago, and one in San Francisco. The Arts and Skills program is planned in such a way that groups work together for a common purpose. There is one general chairman and numerous subchairmen. In this way, much can be accomplished without any one person devoting full time to it. My part is ceramics. The ceramic project was one of the later ones to be opened be-

Myrtle Meritt French

cause of the cost and the fact that it was not as simple to launch as, for example, leather, weaving, and drawing. The Arts and Skills project in Chicago was not started until March, 1943, so as yet we have no ceramics which is at all representative. The two hospitals in which we work are located in and near Chicago. The project should not be confused with occupational therapy. It is an effort to speed recovery by boosting morale.

"The following statement sent out by the Red Cross explains the project further:

" 'The Arts and Skills Unit of the Hospital and Recreational Corps was organized the first of the year by the Volunteer Special Services of the American National Red Cross in Washington with the advice of the Military and Naval Welfare Service and with professionals in the fields of arts and crafts. Its purpose is to aid in the recovery of the sick and disabled soldiers and sailors of this war, through useful and creative work of various kinds. Its plan is to accept the services of skilled artists and craftsmen to teach in military and naval hospitals as volunteers under the Red Cross.

" 'The object is to provide constructive and creative occupation to men during the recuperation period in hospitals and to encourage and help all those disabled to find a resource and possibly a vocation. Volunteers will teach skills of many kinds, keeping a high standard of work in mind. These volunteers are chosen through art schools and museums, and in selecting the best artists and craftsmen in their fields, it is believed that the interest and enthusiasm of the patient will be more easily engaged.

" 'These volunteers will bring to their teaching in the hospitals inspiration and new ideas, giving to this project expert advice and the results of their experience in special fields. It is a time when, as a group, they may be a united and constructive force in helping to return to normal life those afflicted by the war.' "

Mrs. French is extremely well fitted to carry out the work she has described, as can be seen from the following account of her professional life.

She began her ceramic career at Alfred University, Alfred, N. Y., where she received the B.S. degree in ceramics. Not satisfied to stop at that point, she went on to obtain her M.S. degree from the same school and later studied at the Carnegie Institute of Technology, Pittsburgh, Pa., and at the School of the Art Institute of Chicago, the school with which she has been associated since 1921.

Her teaching experience has been wide and varied. For twelve summers she taught ceramics at the Alfred University summer school of pottery. Here she also managed the school for several summers. She taught ceramics for one year at the New York State College of Ceramics and ceramics for four years and weaving for two years at the Carnegie Institute of Technology at Pittsburgh. She also taught weaving at the Art Institute of Chicago for several years. In 1924, she established the pottery department at Hull House in Chicago, one of the oldest and most noted of American social settlements. She worked here, while carrying on her regular schedule at the Art Institute, until 1938. She was also guest lecturer for three years at three Chicago junior colleges.

Along with her teaching, she has designed and made many pieces of ceramic ware which have been exhibited in the International Exhibition at the Metropolitan Museum of Art, New York, N. Y., at the National Ceramic Exhibition, Syracuse, N. Y., and in galleries in New York, Detroit, Philadelphia, and Chicago. Her exhibits have won her the Logan Medal, the Binns Medal, and an award for excellence in pottery design given by the National Alliance of Art and Industry.

Mrs. French is a Fellow of The American Ceramic Society. Active in the Art Division since 1926, she has served as chairman of the Papers and Program Committee (1926–1929); chairman, Exhibition Committee (1929–1930) and cochairman (1930–1931); secretary (1930–1932); chairman, Nominations Committee (1934–1935); and as a member of the Society Nominations Committee (1940–1941).

She is also a member of Delta Kappa Gamma, a national organization of women teachers who are outstanding in their chosen profession, and of various Chicago art groups.

She has written many articles for ceramic publications and has been a contributor to the Encyclopaedia Britannica.

Her hobby is photography. She also likes to travel. She visited the British Isles and Scandinavian countries in the summer of 1929, where she gave special attention to ceramics. She usually spends her vacations in Alfred, N. Y., her home town. What little spare time she has is spent in gardening and hiking and driving around the country.

UNIVERSITY OF ILLINOIS

Government Cooperative Research Project

A research project on the development of ceramic coatings for exhaust systems, with a Government appropriation of $25,000, has been accepted by the Board of Trustees of the University of Illinois, Urbana, Ill. The investigation was requested by the Army Air Force of Wright Field, Dayton, Ohio, and will be conducted by the Engineering Experiment Station in the Department of Ceramic Engineering. It will involve studies on porcelain enamels and other ceramic coatings for use on the exhaust systems of airplanes.

The project has a direct bearing on the war program, as ceramic coatings on ordinary steel will save strategic stainless steel now being used for these exhaust disposal systems. Studies of corrosion resistance, physical conditions, and certain special properties of the ceramic coatings will be made both in the laboratory and under service conditions.

SENIORS AT GEORGIA TECH

Things are taking a sudden and peculiar turn here at Georgia Tech. After the Department was denounced as unnecessary by the Navy last spring, Lane Mitchell and I naturally took steps to serve in a needed capacity, which for Lane and me turned out to be the Navy. Now it seems that the Navy has sent us seven transfers from Alfred, and the Army is returning five or six seniors whom they could not take care of. So rather than being closed, we have our largest senior class in history.

—CHARLES F. WYSONG

MRS. W. E. S. TURNER HAS GLASS TROUSSEAU*

When Miss Helen Nairn Monro was married to Professor W. E. S. Turner of Sheffield University in St. Giles' Cathedral, Edinburgh, the other day she made history as the first bride to wear a wedding outfit woven from colored-glass silk. Her dress was of pale blue. Her hat, shoes, even her handbag, were made to match—all from glass silk.

Professor Turner is one of the world's authorities on glass technology. His bride also is an expert on glass, specializing in glass engraving and instructing in glass technology at the Edinburgh College of Art.

Dresses had been made of white glass silk, but the process of weaving the colored material is said to be quite new.

* From the *New York Times*, July 25, 1943.

Value of Autumn Meetings
Is in Informal Planned Discussions
And Increased Brotherhood Relations

NECROLOGY

BENJAMIN DEPUE HARDESTY

Benjamin DePue Hardesty, general manager of the Mayer China Co., Beaver Falls, Pa., died June 14, 1943, at the age of fifty-eight.

Born in Ravenswood, W. Va., February 28, 1885, "Ben" Hardesty was the son of the late Robert L. and Alice Hardesty. He started to work for the Mayer China Company as an apprentice in 1899. In 1902, he accepted a position with the Huntington Pottery in Huntington, W. Va., and in 1910 he moved to Canonsburg, Pa., where he was associated with the Canonsburg Potteries. Several years later, Mr. Hardesty became affiliated with the Anchor Pottery, Trenton, N. J. He went to a Syracuse, N. Y., pottery as superintendent in 1917, and in 1919 returned to the Mayer China Company in the capacity of superintendent. He was appointed general manager in 1934 and continued active control until his recent illness.

Mr. Hardesty was a past-president of the United States Potters Association and a member of the labor board of that organization.

He was a life member of Union Lodge No. 259, F. & A. M., of New Brighton; a member of the Beaver Falls Board of Trade and the Rotary Club; and a director of the Beaver Valley Country Club. Until his illness, he was chairman of the board of trustees of the First Presbyterian Church in Beaver Falls.

He is survived by his widow, Mrs. Mary Martin Hardesty, and one daughter.

Mr. Hardesty had been a member of The American Ceramic Society since 1918 and was one of the group of sixty-eight ceramists who toured Europe in 1928.

Benjamin DePue Hardesty

LUKE U. MILWARD

The ceramic industries mourn the loss of Luke U. Milward, president and founder of the Electro Refractories & Alloys Corp., Buffalo, N. Y., who died June 9, 1943, in the Buffalo General Hospital.

Born in Lexington, Ky., October 17, 1887, Mr. Milward founded this Company six years after he went to Buffalo in 1913 as district sales manager of the Anchor Packing Co., Pittsburgh, Pa.

Luke U. Milward

His plans were big, for a young man of thirty-two years, when he set up some small buildings in Blasdell, a suburb of Buffalo, to begin his meteoric career as an industrialist. His vision and determination, however, carried him successfully through his trying first ten years to see his Company emerge in and retain a position of great importance in the ceramic field through the production of silicon carbide enamel furnace muffles, tunnel kiln furniture, and other electric furnace products.

Mr. Milward's greatest source of pride was the loyal organization which he had hand-picked. This is borne out emphatically in his will which contained generous provisions for his key employees. To these men he left his stockholdings in the corporation in the form of a trust. This is their reward for loyalty and assistance in the building of this company to one of national reputation. Through this magnanimous act, a monument is produced

to Mr. Milward's accomplishments, and the maintenance and strong future of his organization are assured.

Mr. Milward, active in national ceramic circles had been a member of The American Ceramic Society since 1935.

JOSEPH L. NUNES MISSING

Lieutenant Joseph Leon Nunes, an honor graduate of the Georgia School of Technology in 1940, a Battelle Fellow in 1940–1941, and a member of The American Ceramic Society, has been reported missing in action in a European air engagement.

Lieutenant Nunes has been unofficially reported wounded but safely landed in a neutral country. He has three brothers and one sister serving in the armed services, and a fourth brother is a welder at the Charleston Navy Yards.

At the time of his injuries, Lieutenant Nunes was acting as pilot of the Flying Fortress, "Rambling Wreck," named in honor of the famous Georgia Tech song.

CHARLES F. KOCH

Charles F. Koch, National Sales Corp., Cincinnati, Ohio, died February 17, 1943, following an illness of several years.

Mr. Koch was born January 15, 1869, in Cincinnati, Ohio. After being graduated from the Woodward High School in Cincinnati, he attended the Massachusetts Institute of Technology, Cambridge, Mass., where he received a degree in mechanical engineering in 1891. Following his graduation, he became associated with the Norfolk & Western Railroad and later with the New York Central Railroad at Indianapolis, Ind., and Dunkirk, N. Y.

In 1898, Mr. Koch joined his brother, August W. Koch, in the Cambridge Tile Mfg. Co., Covington, Ky., which had been formed in 1887. He remained with this Company until 1912, when both brothers disposed of their interests to the present management of the Cambridge Tile Mfg. Company.*

Mr. Koch's association with his brother continued in the formation in 1912 of the National Sales Corp., Cincinnati, Ohio, producers' and manufacturers' agents for numerous materials used in the ceramic industry.

Mr. Koch was well known as an inventor. One of his better-known inventions was the automatic tile machine, a machine widely used in the tile industry for sizing and warping floor and wall tile.

He had been a member of The American Ceramic Society for twenty-six years.

* A historical sketch of this Company is given on p. 131 of the May, 1943, *Bulletin*. Mr. Koch's association with the Company is therein briefly reviewed.

ENAMEL DIVISION V-DAY VISIONS

TECHNICAL MEN IN THE ENAMELING INDUSTRY*

By A. I. Andrews

One of the important losses of the enameling industry brought about by the war is the fact that a great many technical men have been inducted into the services or have left the enameling industry for employment in the war industries. The enameling plant executives who have been able to keep these men by utilizing their abilities for heat-treating or other conversion work are fortunate, as there undoubtedly will be a great shortage of technical men after the war. Although some of the men in service and some of those in war industries may return to their former employment, it is probable that the services will keep many of them and others will be established permanently in other industries. The postwar program as it is shaping up at the present time calls for many technical men in the service. These men will be needed in the devastated countries to aid in rebuilding a new peacetime structure which we all hope will be permanent. This undoubtedly will take many years, and our resources in technically trained men are going to be sorely depleted.

The training of technical men for the industry has already come almost to a standstill. The universities and colleges of the country are unable to keep up their enrollments, as nearly all men of college age are entering the armed services. The problem in the educational institutions is becoming so serious that departments are being discontinued and many schools are facing the possibility of closing down completely and permanently. Few departments of ceramic engineering may be able to survive if the war lasts a year longer. This is true in most colleges, and the Army and Navy are utilizing and planning to utilize many of these colleges and universities for Army or Navy specialized training. The teaching staffs already are depleted by the services and the industry, and most of those remaining will be absorbed by these service programs. It is evident to anyone associated with education that, for the duration, few men will be trained for the industry even in the strictly scientific or engineering branches.

There is a great shortage of scientific and engineering personnel, and a new supply will not be trained until after the war. There is a great backlog of demand building up for enameled ware. There is also a big backlog of demand building up for technical men, not only in the ceramic industry but in all industries. The enameling industry will have to compete with all of these other industries for what is available, and, what is more, the enameling industry needs much more technical help than it has ever had.

Based on present indications, the situation may be summarized as follows: Immediately after the war the enameling industry will have to compete with other industries for technically trained men. Few men will be available from the colleges and universities until a new group has time to pass through the college curriculum. Some men may be obtained who will be trained in refresher courses in the educational institutions. Many of the men returning from service will want to readjust themselves by a semester or year course in college before entering the industry.

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Enamel Division). Received April 20, 1943.

The Porcelain Enamel Institute Forum Committee may organize enamel short courses in cooperation with the universities, as in the past. These courses could last a week or two and, instead of the conventional forum papers, be made up of lectures and laboratory work presented as regular classes, with homework, written assignments, and examinations. In addition, extension courses and plant training schools for employees could be organized.

DEPARTMENT OF CERAMIC ENGINEERING
UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS

OUR PEACETIME INDUSTRY*

BY CHARLES S. PEARCE

I. Introduction

The porcelain enamel industry is faced with the problems of unlimited expansion which will occur in the years following the war. "Unlimited" is the term that most nearly describes the expansion which will take place in the ten years following the termination of the present conflict. This statement will be confirmed by a look at the immediate future and by a study of the long-range prospects.

This study should be broken down into three periods which should be viewed separately, namely, (1) the remaining period of the war, or the duration; (2) the immediate postwar period, or V (year of victory) to V plus 2; and (3) the later postwar period, after V plus 2.

II. Future Prospects

(1) Remaining War Period

For the duration, the industry must be considered to be part military and part civilian. Military uses of porcelain enamel include four or five groups. In housing the Army, porcelain enamel is used largely in the plumbing, feeding, and heating fields.[1] These needs have been met almost completely, and little expansion will take place in domestic cantonment building. Because of the permanence of porcelain enamel, replacement will be small.

If the war drags out and the Army assumes a more permanent character, facilities for housing the forces may be changed to permanent buildings. In this case, much new equipment may be used.

Fighting equipment will find some uses, although these uses will be negligible compared with peacetime usage. Some items are now being developed, e.g., plumbing for use on shipboard to replace critical metals; exhaust equipment and firewalls for aircraft; and protective coatings where salt air and humidity are factors.

Civilian housing for Army personnel, such as officers' quarters and houses for married enlisted men, may continue and will be expanded greatly if our military organization becomes permanent.

Civilian uses in wartime will return to some extent if the war drags out. Already victory models of stoves and tremendous amounts of kitchenware are being produced. Refrigerators, washing machines, and other civilian items will not be far behind.

Housing has seen the introduction of one new item, namely, smoke pipes, but for exterior uses porcelain enamel seems to be "out" for the duration, after a good start in the latter days of peace.

Commercial uses, such as storefronts and interior trim, will be out for the duration because of the reduction in retail outlets as well as the shortage of steel. Commercial food-handling equipment will be limited by the same factors. New restaurant installations will be few and far between.

Civilian manufacturing equipment will be irregular. Bakeries may be expanded in some cases. Gasoline and rubber plants will be tied in with military requirements. Beer and distilling uses will be limited greatly. Food processing presents a brighter picture, as it may be expanded for lend-lease and for the foreign relief programs.

After the domestic uses, a field new to Americans remains, namely, export. Little is known of the market for porcelain enameled products in foreign countries, but necessity will force companies in this country to recognize the export market. The increase in military items made to resist sandstorms and salt air plus humidity may demand porcelain enamel or other inorganic coatings. The greatest opportunities, however, still lie in the civilian field.

South Sea wampum illustrates the foreign uses for porcelain enameled products. Bright-colored kitchen pots and pans will persuade the natives to work when gold holds no allure. The fascinating work of the Board of Economic Warfare is proving this fact. Large markets may develop in this field as the means for transporting this material to foreign countries become more available.

Some industrial products will be exported, especially food-processing equipment. But all of this work will fail to keep the porcelain enamel industry alive, when millions of stoves and refrigerators have been its market. Other work, such as heat-treating, bombs, aircraft and ship work, and armor plate must be obtained.

(2) Immediate Postwar Period

This is the period of (1) 1942 automobiles and refrigerators, (2) quantities of 100 octane gasoline and nothing to use it in, (3) a great civilian urge to fly and few small airplanes, and (4) wanderlust for Americans and broken-down worn-out railroads.

We will have plenty of magnesium and nothing to use it for and plenty of stainless steel and no great "vacuum" market for it to flow into promptly. No tremendous purchases will be made by the public unless inflation becomes rampant. Purchasing will be normal, or less, largely because the new designs for which the public is yearning will not have been created. The new products which will be available will have an old look.

The porcelain enamel industry will return to its old products and its old markets, but much more imagination will have to be shown in the future than has existed in the past if the industry is to be ready with a new line of postwar products.

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Enamel Division). Received April 20, 1943.

[1] See also "Porcelain Enamel in War Work," by C. S. Pearce, *Bull. Amer. Ceram. Soc.*, **21** [8] 162–64 (1942).

An explosive situation will exist, namely, the attitude of the men coming back from Government service. Management will expect to welcome the office boy back to the organization, only to find that he has risen to a captain in the Army or a commander in the Navy. Men who were operators will have new horizons. That was true in part in the last war, but it will be more pronounced after this one.

So the interim period immediately after the war will be one of great churning around, and many new companies will be churned up. These companies will probably be headed by some competent young men who will have escaped largely from our industry to other industries or to the Army during the war. These new companies will spell the beginning of the third period, or the real postwar period, a period of real change and development.

(3) Real Postwar Period

The competitive materials will be metals and plastics—materials which do not need finishes. And they will really compete! This competition, however, can be met by new processes and new materials. The Porcelain Enamel Institute is organizing two committees in this field which will be at work soon.

What will be possible? First, let us look at processes. It is safe to assume that all of the following changes will be tried and that some will have a large influence on manufacturing methods and costs.

We will develop new methods of cleaning iron and steel (certainly there is plenty of room to start in this process) and controlled humidity drying (little is known in this field, but much could be learned to our advantage). Induction heating will attract attention. Maybe it is practical, maybe not—who knows?

Automatic dipping—look at the kitchenware industry and let your imagination wander. Automatic handling in this branch would also affect the competitive position of companies. Controlled application, especially in spraying, has been developing for ten years, but it is not completely effective yet.

These are just a few of the suggestions for the bright young men who will be "rarin' to go" when the war is over.

There probably will be a renaissance in materials, i.e., cast iron, such as has occurred already in the automotive industry and which may occur in the appliance industry. It is sure to occur in the machinery industry just at a time when the importance of finishes is being recognized in that industry. Better castings—more enamelable castings—will be produced.

Better sheet metal will be available. Remember the advances made in sheet metal in the last war. The newer sheets will not warp and twist so much when heated, and they probably will be free of hydrogen (or whatever it is that is blamed for all of the enamel defects). These new sheets will draw and form in ways which we now think are impossible and they will hold their shape when enameled. We will do many things with sheet iron and steel in new ways.

Porcelain enamel may come to represent only the small group of inorganic coatings which is known today, but the range is broadening daily. Tomorrow we may have five different inorganic finishes which will fall into the following classes:

(1) A protective coating baked on at approximately 800°F., which is on the market today and will move along into its proper place. By and large, it is a coating to prevent corrosion, and it is a cheap substitute for hot galvanizing.

(2) A decorative coating fired on at approximately 1100°F., which may be similar to the old jewelry enamels. It will have a gloss but will not be very resistant, so it will be used largely for decoration when long life is needed.

(3) The conventional porcelain enamels which are known today and which fire on at approximately 1400° to 1650°F. They may be called "domestic" because they will be used for household appliances. These enamels will constitute the large production field and, as in the past, will be the backbone of the industry. Measured in terms of frit, the industry may be as large as 200,000,000 lb.

(4) A group of enamels which to date has received a premature glance, namely, resistant finishes which will fire on at temperatures up to 1900°F. They will be similar to the old enamels which were used forty years ago and will be especially useful if they can be matched up with a proper steel. Architects may find a good finish in this group which will be highly resistant, especially to weather.

(5) A refractory coating which will adhere to sheet steel or plates and will stand temperatures of 2100° or 2200°F. This group holds promise for use in the industrial field.

This is the picture of the industry and its general characteristics in the later postwar period. The materials and the processes are available, with a little research work, to make a wide range of products possible.

When the war is over, the third element, men, will be ready to create a large finishing industry which will serve the needs of the peacetime world.

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FUTURE OF ENAMELING*

By B. T. Sweely

I. Introduction

The approach to a discussion of this subject is made with a full realization of the writer's rather limited ability to view the subject as a whole and to analyze or predict the future of our industry. Out of the past, however, may come some thoughts which will be of use in looking at what the future may hold.

Our Program Committee hoped that a symposium on this subject would formulate a policy or plan for our

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Enamel Division). Received April 20, 1943.

Division activity during the course of the war and lead to a postwar program that would be of value. If even a small realization of this hope is attained, it cannot be other than helpful to porcelain enameling in all of its various phases.

II. Technical Advancement a "Must"

As we are primarily interested in the technical aspect of our industry, we will confine our discussion to what we can do to improve this phase of porcelain enameling, for we well know that any real technical advance in any product is always followed by an enhanced economic value and consequent increased public use. As a correlary, if we fail to attain such improvements, our relative position at the war's end will become increasingly unfavorable, as competing materials and finishes will be ready and eager to take advantage of any failure on our part to keep step with the need of improvement of the materials and processes of our industry.

Two of the materials of porcelain enameling present problems which should challenge the interest of every enameler, namely, enamel and steel; to these two problems is added a third, the problem of shop processing. Which causes the defects in our industry—enamel, steel, or processing? Would it not be well to seek an answer to this question? All parties to the controversy recognize their possible responsibility for these defects, but none can prove their innocence. Would it not be well if we could provide a means of telling whether enamel, steel, or processing is below standard, not so much to end the controversy but for the far more important purpose of overcoming these difficulties in the manufacture of porcelain enameled products?

Porcelain enamels have been improved, but one would be fearless indeed to claim that the ultimate has been reached with the frits now in use. Greater working range, freedom from defects, and covering power are all problems crying for solution, and these improvements will not be easy to attain. Fundamental research and its application to enamel or frit-making was never more essential to meet the challenge of competition than during this lull in the production and use of porcelain enamel. The leadership for such research *must* originate in this Society; there is no other probable source.

The sheet steel we enamel is also essentially our problem. Improvements in the enameling characteristics of sheet steel are as vital to the porcelain enamel industry as improvements in enamels. The manner in which they should be improved is not the question. Like enamels, they are in need of improvement, and, as gains in sheet quality are attained, decrease in the cost of products and a wider field of public acceptance and use of porcelain enameled products will follow, with consequent benefit to both sheet producer and enameler.

Shop processing is the enameler's problem, and as such it becomes essentially a problem for which the Enamel Division bears no small responsibility. A cooperative study of the processing of ware in the enameling plant falls easily within the scope of the membership of this body, and it has received far less attention from this Division than its importance deserves. Although it is true that enamel shops and departments are not operated for laboratory study, we have yet to see the enamel shop that would not benefit from a better measure of what constitutes good cleaning, application, and firing procedures. A review of our technical literature, which would correlate all available information into a pamphlet entitled "Good Practice," might be of real benefit to those of us responsible for shop operation.

III. Solution Lies in Research

What are we going to do about these problems? Although the appointment of committees is not a solution of any problem, without a properly financed research organization to whom we can submit our problems, it is the only way for the Division to function.

We must keep in mind that the manufacturer who uses porcelain enamel on his product has no interest in porcelain enamel as such. His problem is to provide a finish that appeals to and satisfies his customers. In the past, he has used porcelain enamel because of its permanence. Competing materials have possessed all of its other properties for some time, but permanence has been our "hole card." Quite probably our manufacturer has had a good many complaints to register against porcelain enamel. He probably objects to the damage incurred on his assembly lines and in shipment, the delays his production suffers from rejects and rework, and his inability to schedule a definite number of parts and be assured of the production of a definite number of finished products. He is looking eagerly at all times for a simplification of his manufacturing problems and will welcome the promises of our competitors if they can substantiate their claims.

Fortunately, in the past, we have produced the only permanent finish for iron and steel, and it has been comparatively easy to create sufficient dissatisfaction with other finishes to hold a substantial amount of the finishing on these products. To assume that this will continue to be the case is to invite disaster.

A properly financed research organization would be the wisest investment the industry could make. Every individual, or company, whether he has one small box furnace or a dozen continuous furnaces, has a vital interest in the improvement of the materials and processes that are producing the parts used on his product. In addition to the enameler and frit manufacturer, we should have the support of the steel industry, for it, too, faces the threat of competition of other metals in our field where steel has been pre-eminent in the past.

Such a plan, of course, is utopian, and the man capable of rallying the divergent interests of our industry to the support of such a project really should not be wasted finding a solution to our troubles. He should be made chief coordinator of our Washington alphabetical agencies and bureaus. As we can scarcely hope to realize the millenium, we had best seek a more feasible attack, and a closer cooperation between our Enamel Division and the Porcelain Enamel Institute is indicated. Few of us are in a position to subscribe financial support to any project, but the Institute has as its members the plant owners and managers who must provide the funds to support any real research program. It is unfortunate, but nonetheless true, that research costs money. Unless we can secure financial support for an adequate research program, most of our discussion is a waste of time, and we will continue our

rather impotent attempts "to do something about" a problem that can only be solved by full-time, intensive investigation.

There can be no conflict between the Porcelain Enamel Institute and the Enamel Division of The American Ceramic Society. Both are vitally interested in furthering the use of porcelain enamel and consequently should be working in the closest harmony. The Enamel Division is interested primarily in the technical phase of the industry, whereas the Porcelain Enamel Institute devotes itself to the commercial exploitation of our product. For either organization to encroach on the field of the other is economically unsound and a waste of effort.

At a recent meeting of the Porcelain Enamel Institute, research was given more than a passing glance. A committee was to be appointed to see what could be done to promote more activity in this vital phase of the industry. A carefully selected committee should be appointed by our Division to work with the Institute on the formulation of a research program for the industry. There surely is sufficient ability in these organizations to secure results of great value if properly applied.

IV. One More Suggestion

In all organizations such as this Enamel Division, there is a tendency to rely too much on the older members. The war, of course, has drained away many of our younger members, but in too many instances decisions are made by the "oldsters" who know too well a certain thing cannot be done. Promote our younger members to positions of responsibility. Let youth have its fling, if you please, and some of the difficulties we think are unsurmountable may be overcome by some young fellow who does not know "it can't be done."

Chicago Vitreous Enamel Product Company
Cicero, Illinois

ENAMELED UTENSILS*

By A. I. Andrews

The enameled utensil manufacturers' group is well organized and its production has increased because of the war. This was brought about by the removal of aluminum and stainless steel from the consumer market. The Bureau of Census figures for the past few years are as follows:

Year	Value of product
1939	$15,480,000
1940	15,854,000
1941	23,446,000
1942	22,444,000

The production for 1943 will probably decrease. The number of commercial items has been curtailed to the following:

(1) Multiple coat—one size each of the following items: Double boilers, washbowls, ladles, water pails, dishpans, saucepans, percolators, and covered pots.

(2) Mottled gray ware—one size: Washbowls, ladles, water pails, dishpans, coffee boilers, covered kettles, and covered pots. Three sizes: Stock pots.

(3) One-coat blue—one size only: Roasters.

Many of the orders for 1943 will be on Government contract. Prospects for the future are favorable, but until the demand for steel in the war effort is satisfied, no great consumer market can be supplied.

Postwar Prospects

There are many differences of opinion as to the probable demand for enameled kitchen utensils after the war. Competitive materials and products unquestionably will come on the market to supply part of the expected backlog of demand. The principle materials in this group are stainless steel and aluminum. Others are glass, cast iron, and pottery, but, based on past performance, these latter materials should not be serious competitors.

Stainless steel will be available, but because of its cost, it probably will be a de luxe product unable to compete with enameled ware and aluminum on a cost basis. It is durable, but it does not appear to be clean after long use, and scratches on it are ugly looking. It will, however, find a place for itself.

Much is heard about the part aluminum will play after the war. It will certainly be in demand for many purposes beside kitchenware, e.g., airplane, railway-car, boat, and automobile construction where weight is important. Even less aluminum, therefore, may be available for kitchenware after the war. The War Production Board figures estimate a maximum production of one million tons of aluminum per year. Steel production is estimated to be 100 million tons for 1943; if 20% of that were sheet, which is a fair figure, there would be 20 million tons of sheet steel. Reducing this to one-half, as a low peacetime production, 10 million tons would represent the market of sheet metal which the one million tons of aluminum would have to supply.

Enameled Utensil Manufacturers' Council Program

The enameled utensil manufacturers have a strong organization which consists of practically all of the plants in the United States manufacturing this type of ware. A long-time program of publicity and research has been under way for several years, and much progress is being made.

The publicity program includes radio skits from hundreds of stations throughout the country. Informative articles are being published in newspapers, magazines, and as special bulletins. One rather extensive bulletin describing the manufacture, use, and care of enameled kitchen utensils has been distributed widely. The program is nationwide and benefits the entire enameling industry.

The research program was organized as a cooperative project at the University of Illinois in 1940. Test methods have been developed for impact testing, thermal-shock resistance, and solubility determinations especially adapted to enameled kitchen utensils. These tests have been incorporated into National Bureau of Standards' Commer-

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cial Standards and are also used in many of the Government specifications, such as the following:

Treasury Department, Procurement Division, Specification for Enamelware; Bakeshop and Kitchen, No. 523, December 11, 1941.

Treasury Department, Procurement Division, Proposed Specification for Enamelware; Hospital and Sickroom, November 24, 1941.

Quartermaster Corps, Tentative Specification; Container, Round, Insulated, M–1941. J.Q.D. No. 50A, December 16, 1942; superseding J.Q.D. No. 50, December 31, 1941.

Bureau of Ships ad interim Specification, General Specification for Enamel Porcelain (for Coating), July 15, 1942, 52E3 (INT).

The work is continuing, and tests are being developed for hardness, reflectance, thickness, adherence, and gloss. With these tests and improvements in design, the ware on the market has been studied at intervals, and a substantial improvement of the ware over the period of investigation can be shown. Most manufacturers have the equipment for these tests, which places them in a position where they can determine the relative qualities of their different enamels and thereby improve them. The work is continuing with the object of improving the ware on the market so that it will all give better service and have the approval of the housewife.

If the example of long-time planning set by the kitchenware group in both publicity and research were adopted by the whcle enameling industry, much progress could be made. The different groups in the enameling industry should get together, study their problems, lay plans, and all work toward the same end.

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ENAMELED UTENSIL MANUFACTURERS' COUNCIL TENTATIVE STANDARD IMPACT TEST FOR PORCELAIN ENAMELED COOKING UTENSILS*

By G. H. Zink and A. I. Andrews

Abstract

This paper includes a description of the equipment and the method of testing all sizes and shapes of porcelain enameled kitchen utensils. The factors influencing the development of the equipment and the test procedure are discussed in detail.

I. Introduction

For some time, the need of a universal method for testing the impact resistance of porcelain enameled cooking utensils has been recognized by the manufacturers, and a great deal of work has been done by the individual plants in testing both their own and some of their competitors' ware. In the past, each manufacturer has had his own type of equipment and method of testing for impact resistance.

The equipment used by the various plants has included both the "swing hammer" or "pendulum" and the "falling weight" types of impact testing machines. The method of testing, when using either type of machine, has consisted in allowing the impact weight to be released from some starting point and repeating the procedure on the same point of impact, but increasing the height of release each time until the enamel failed by chipping. In using either type of equipment, however, the point of impact has been varied over the outside bottom circumference of the utensil and varying results have been obtained.

The purpose of the Enameled Utensil Manufacturers' Council Tentative Standard Impact Test for Porcelain Enameled Cooking Utensils is to provide a universal method of testing for impact resistance with the use of a universal machine.

II. Factors Influencing Development of Equipment and Test Procedure

Many factors entered into the development of the E.U.M.C. Tentative Standard Impact Test for Porcelain Enameled Cooking Utensils, namely, (1) a solid or firm base; (2) a method of allowing the weight to fall with the least restriction possible; (3) the ease of setting up the equipment; (4) the simulation of service conditions; (5) the repeated striking of the falling weight at the same point until failure; (6) a range of values which included the majority of ware available to the public; (7) reproducible results; (8) the simplicity of test procedure; (9) the speed

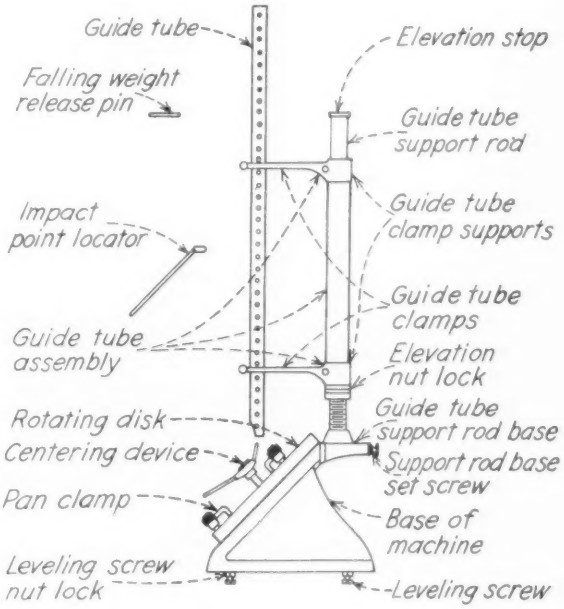

Fig. 1.—Sketch of E.U.M.C. impact machine.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Inc., Cincinnati, Ohio, April 21, 1942 (Enamel Division). Received April 21, 1942; revised copy received May 6, 1943.

of operation; (10) the cost of equipment; and (11) the cost of operation.

III. Description of Equipment

The "falling weight" type of equipment used in testing the impact resistance of all sizes and shapes of enameled cooking utensils includes a E.U.M.C. standard impact testing machine used for control purposes by the manufacturers when testing either the standard 2-qt. test size or any of the 2-qt. sizes of pudding pans available to the public, plus sufficient adapters for converting from this type of machine to one which is used for testing all sizes and shapes of ware.

The E.U.M.C. standard machine, shown in Figs. 1 and 3, weighs approximately 190 lb. and consists of a heavy cast-iron base; a rotating cast-iron disk, 12 in. in diameter and 1 in. thick and set at an angle of 45 degrees to the horizontal; a $^3/_4$-in. vertical steel guide tube held in position by two cast-iron guide-tube clamps, the lower one being held in position by a vertical key which is attached to a sliding clamp support stop; a steel guide tube clamp support rod, movable in a cast-iron support-rod base with a fine adjustment arrangement which is attached to the machine base proper; two steel impact weight release pins; a 135-degree-angle impact point locator; and a $^3/_4$-in., 10-gm., Duralumin ball used as the impact weight. As an aid in centering the test pan and for speed in operation, a centering device, consisting of three adjustable prongs set in a head and kept in position by a spring on a rod, is located in the center of the rotating disk. Three evenly spaced spring clamps near the outer edge of the disk hold the test pan firmly in position, and ten evenly spaced marks at the outer edge locate the points to be tested on the bottom

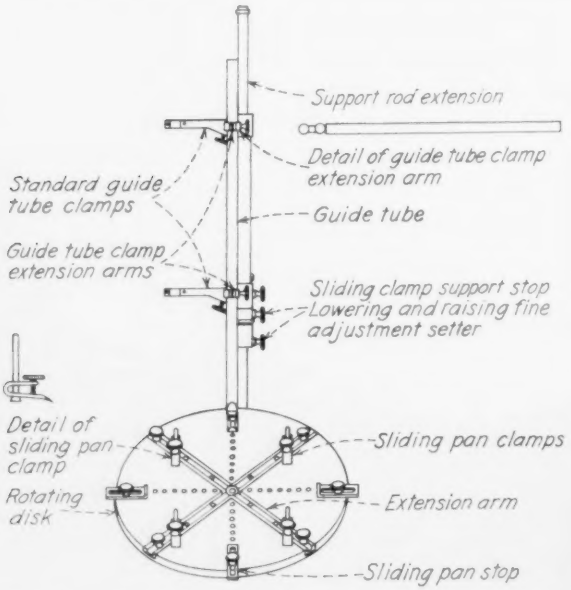

FIG. 2.—Sketch of E.U.M.C. impact machine with adapters.

radius of the test pan. The vertical guide tube, cut away at the front to allow the fallen weight to escape after impact without moving the tube, is perforated at 1-in. intervals. Two niches are cut in the bottom of the guide tube which, with the simultaneous use of the impact point locator, serve to locate correctly the point of impact on the bottom radius of the test pan. A bubble level set on the support-rod base and three leveling screws set in the underside of the machine base proper permit ease and speed in leveling the machine before beginning the test.

For testing all sizes and shapes of enameled cooking utensils, the standard machine base proper, vertical guide tube, support rod, and support-rod base are used with converting adapters, as shown in Figs. 2 and 4. These adapters are, namely, (1) a 2-ft. diameter rotating cast-iron disk, 1 in. thick, which, when in position, is offset to permit true alignment with the guide tube in its new position and to compensate for the increase in size; (2) two extension arms with guide-tube clamps attached; and (3) a support-rod extension. Slots at 90 degrees to each other are cut across the face of the rotating disk into which four extension arms fit, each of which may be set in any one of three positions so that large oval, square, or rectangular shapes, as well as large, round, cooking utensils may be tested. A sliding

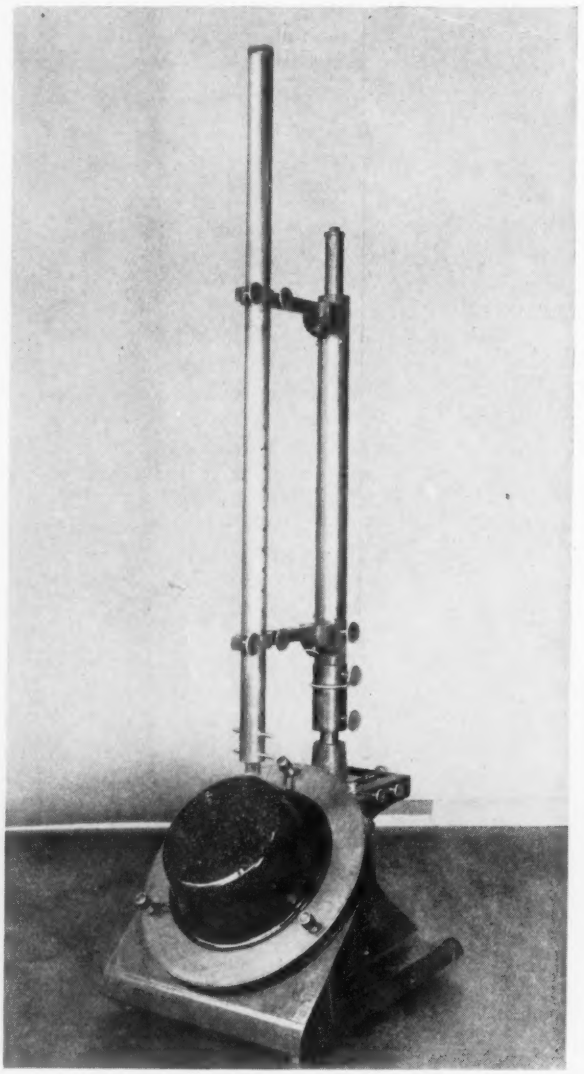

FIG. 3.—Standard impact machine.

clamp fitted into a slot in each of the four extension arms adds to the elasticity of the machine. Four sets of tapped holes, at 1-in. intervals, extend from the center to the outer edge of the disk at 45 degrees to each of the four extension arms and at 90 degrees to each other. These holes provide setting points for the four sliding stops which hold the test piece in position and which, with the use of scribed circles radiating from the center to the outer edge of the disk, are used to center the utensil approximately before beginning the test. The two guide tube clamp extension arms fit into the base of the two standard machine guide-tube clamps, but at 90 degrees to them, and are held in position by set screws. The extension arms are marked at $^1/_2$-in. intervals for ease and speed in adjustment and at the same time hold the guide tube in a vertical position. The support-rod extension threads snugly into the standard machine guide tube clamp support rod, thus permitting the guide tube to be raised sufficiently to test utensils with great height and also adding to the elasticity of the test machine.

IV. Method of Testing All Sizes and Shapes of Enameled Cooking Utensils

(1) Leveling the Machine

The converted standard impact machine should be placed on a firm foundation and, using the bubble level as a guide, leveled by the three leveling screws. Upon reaching a level position, the nuts on the leveling screws should be tightened to lock the leveling screws in position.

(2) Adjusting the Guide Tube

After the clamps are loosened, the 3-ft. guide tube is rotated until the two niches at the bottom of the tube are in a line parallel to the front of the machine. The guide tube is raised or lowered simultaneously so that the two clamps fall between perforations, which are spaced 1-in. apart, with the lower clamp set at a point approximately 6 in. above the bottom of the tube. The clamps should then be tightened sufficiently to hold the guide tube in its desired position.

After loosening the bottom clamp support set screw, the guide-tube assembly, consisting of the guide tube and the two clamps and clamp supports, should be raised by lifting the bottom clamp support above the guide key and should be swung in a clockwise direction. This operation places the guide tube out of the way of the operator when he is clamping test pieces into position and also when he is changing the setup from one shape and/or size of utensil to another.

(3) Centering and Clamping the Test Piece Into Position

The inverted test piece is placed on the rotating disk and centered approximately by the circles scribed thereon. The four sliding stops are then brought in contact with the test piece and tightened, after which the four sliding clamps are brought into position and set to hold the utensil firmly against the rotating disk.

(4) Locating the Correct Point of Impact

The guide tube is swung back into its normal or working position with caution so that it is not allowed to rest upon the test piece. If the guide tube does touch the test piece before the normal or working position is reached, it may be raised by loosening the two set screws in the sliding clamp support stop and by raising the stop and the guide-tube assembly to a height sufficient for clearance, after which the set screws are tightened to maintain the desired position. At this point, it may be necessary to loosen the set screws holding the guide tube clamp extension arms so that the guide tube may be moved to its approximately normal or working position and then tighten the set screws to hold the arms in their desired position.

As the machine is now leveled, the guide tube is adjusted, and the utensil is in position for testing. Only two adjustments, which may be made simultaneously in one or the other of two ways, are necessary to obtain the correct point of impact with the impact weight. The set screws in the support-rod base and the top set screw in the sliding clamp support stop are loosened to permit both the backward or forward and the raising or lowering fine adjustment movements of the guide-tube assembly. The correct point of impact on utensils which have a bottom radius of less than $^1/_2$ in. and a bottom diameter of not over 7 in. may be ob-

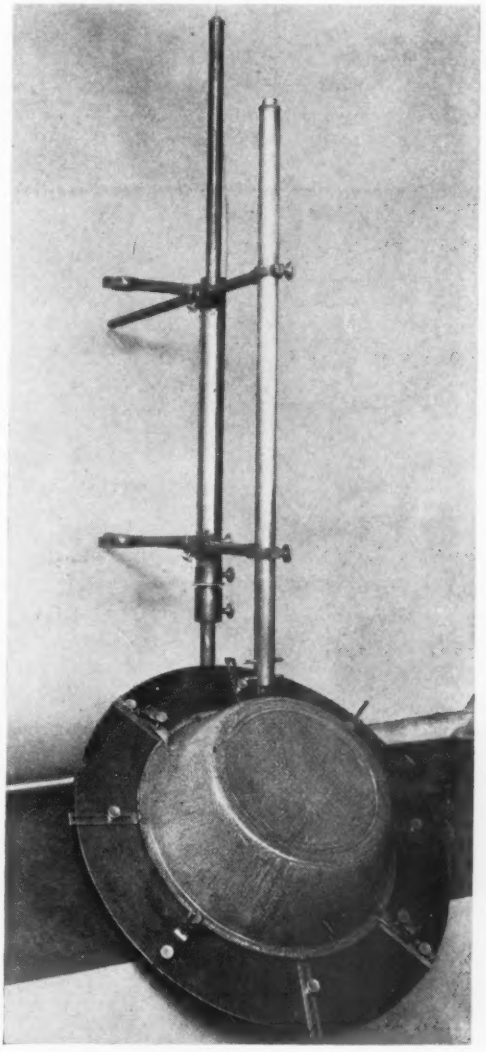

FIG. 4.—Multipurpose impact machine.

tained by either one of two methods. (1) The impact point locator is placed across the bottom of the test piece with the short arm resting upon the bottom radius directly below the guide tube. The guide tube is lowered by the fine adjustment arrangement in the sliding clamp support stop until it nearly touches the bottom radius of the test piece. The guide tube is moved simultaneously to or away from the front of the machine, as required, until the niches in the bottom of the guide tube are in line with the point of contact between the bottom radius of the test piece and the short arm of the impact point locator. The set screws on the guide tube support rod base should now be tightened to lock the support rod in position, after which the guide tube should be raised to a point $^1/_8$ in. above the bottom radius of the test piece and locked in position by tightening the top set screw in the sliding clamp support stop. The set screw in the lower clamp support also is tightened to prevent a sideway motion of the guide tube and to insure the identical point on the bottom radius being struck by repeated blows until failure by chipping. (2) The guide tube is raised to a point $^1/_8$ in. above the bottom radius of the test piece and both the top set screw in the sliding clamp support stop and the set screw in the lower clamp support are tightened. The impact weight is placed on the bottom radius of the test piece directly below and inside the bottom of the guide tube. The guide tube is then moved to or away from the front of the machine until the impact weight just remains in place, after which the support rod base set screws are tightened to lock the guide tube in position.

When round-shaped utensils are tested, the guide tube should be moved to or away from the front of the machine and raised or lowered a small amount to obtain the correct point of impact for each point of failure; this adjustment is necessary as the test piece is centered only approximately on the rotating disk and some ware is not true in shape. When oval, square, or rectangular utensils are tested, the utensil itself should be moved for nearly every test point and the guide tube should be adjusted, also at each test point, for the correct point of impact.

(5) Pretest Procedure

One of the two impact weight release pins is placed through the lowest set of perforations, and the impact weight is dropped into the top of the guide tube. The second release pin is placed in the set of perforations directly above the now resting impact weight.

When testing round utensils, the rotating disk should be moved until one of the ten evenly spaced marks on the outer edge of the disk is in line with the middle of the guide tube clamp support rod or some other chosen reference point.

(6) Test Procedure

When the utensil is in position and the correct point of impact is located, the test is begun by pulling the lower release pin, which allows the impact weight to fall and strike the bottom radius of the test piece. After striking the utensil, the impact weight is again dropped into the top of the guide tube, and the previously pulled release pin is placed in the next set of perforations above the again resting impact weight. This procedure is continued until the first chip visible to the normal eye at a distance of 18 in. appears. At this point, the perforation directly below the release pin remaining in the guide tube is noted and recorded as the failure point value, in inches, for this particular point on the test place.

After testing a particular point, the rotating disk is moved until the next mark is in line with the middle of the guide tube clamp support rod or some other chosen reference point. The procedure in the preceding paragraph is repeated; the test is always started by releasing the impact weight from the lowest set of perforations until ten points on the bottom radius of the test piece have or have not failed within the limits of the 3-ft. guide tube.

(7) Calculation of Results

Each utensil is tested at ten points on the bottom radius, and an average is taken for the impact resistance of a particular piece of ware.

Five utensil averages, of ten points each or a total of fifty tested points, are averaged for the impact resistance evaluation for any one size and/or shape of ware.

Acknowledgment

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The authors wish to express their appreciation to the members of the Technical Committee, consisting of E. C. Dexheimer, H. C. Arnold, B. S. Kirk, A. J. Vollrath, P. A. Mallonn, and E. H. Kelsey, for their advice, suggestions, and cooperation.

The authors are also indebted to F. A. Petersen, who by actual use of the equipment, contributed important improvements.

Department of Ceramic Engineering
University of Illinois
Urbana, Illinois

PLANS FOR POST-V DAY

CIVIL ENGINEERS ALSO PETITION FOR BASIC TRAINING

To the Board of Direction April 7, 1943
American Society of Civil Engineers:

Your Committee appointed to draft a statement, or set of resolutions, for adoption by the Board of Direction, in regard to the training of engineers, recommends the adoption of the following:

The report presented by the Committee on Engineering Education to the Board of Direction of the American Society of Civil Engineers on April 6, 1943, reveals that the reserve of those pursuing an engineering education is being depleted to an alarming degree.

It also indicates that the plan of the Army for insuring a continuing supply of qualified engineers through the Army Specialized Training Program is encountering unforeseen difficulties through inability to find qualified men already in the service who can be transferred to the A.S.T.P., and the Program does not provide for the completion of their engineering education.

Canada has wisely employed logical means to insure a steady flow of engineering graduates to the Dominion

Forces and her war industries. Her attitude is ably expressed by L. A. Wright, formerly Assistant Director of the Canadian Selective Service System, in these words:

"This is a young man's war—it is an engineer's war . . . To us, the engineering student has been a precious war material, the supply of which must be guaranteed, the quality maintained, and the distribution controlled."

There are about 68,000 students remaining in the engineering colleges of the United States who have completed part of their engineering education. These are in the R.O.T.C., in some of the Reserves, or in occupational deferment.

It is the opinion of the Board of Direction that these should be required to complete their education. To insure this, the following program is recommended for adoption:

(1) Require all engineering students to continue their education to graduation so long as they maintain the required scholastic standing. Require all engineering students now in the advanced Reserve Officers' Training Corps and the Reserves of the several Armed Services to remain in college until graduation under an accelerated program whereby the usual engineering course can be completed by an entering student in two years and eight months and those already in college can graduate in periods ranging from four months for seniors to twenty months for sophomores.

(2) Induct immediately into the Armed Services and assign to their respective engineering colleges to complete their education those now in occupational deferment and return to their engineering colleges for the completion of their education those engineering students who have already been inducted.

(3) Encourage the qualified graduates of high schools and preparatory schools to enroll in the engineering colleges and, if they are making satisfactory progress when they reach the age of eighteen years, induct them into the Armed Services under orders to remain in college to graduation if they make normal scholastic progress.

(4) Require in the engineering curricula a suitable program of physical education and basic military training.

This program, forcefully prosecuted, could produce for the war program more than 7000 engineering graduates every sixteen weeks.

Too much emphasis cannot be placed on the necessity for a reservoir of graduate engineers who can understand, interpret, and execute orders involving engineering work.

Your Committee recommends the adoption of the program here outlined and that it be forwarded, accompanied by the report of the Committee on Engineering Education, to the President, Secretary of Navy Knox, Secretary of War Stimson, Paul V. McNutt, Director of the War Manpower Commission, and to such others as would appear to be in a position to be helpful.

Approved by the Board: E. B. Black, Charles B. Breed, John W. Cunningham, Ralph B. Wiley, and Thomas R. Agg, *Chairman*

PRIVATE ENTERPRISE IS THREATENED*

Between the job of winning the war and using the war emergency to "remake America," the picture at Washington is one of confusion and chaos. Every pretext is being seized upon to destroy private enterprise and to make permanent the socialistic experiments of the past decade.

The National Resources Planning Board suggests as part of its "cradle to the grave" program that a "Government corporation" purchase railroad terminals and rights of way, making them a part of the public domain along with the highways, waterways, and the air, the ownership and control of which they would operate from a single Federal agency. The Government would then lease back (on its own terms, of course) the use of the rights of way to privately owned railroad companies.

In this way the Government would acquire absentee landlordism over all forms of transportation.

The public is usually given some plausible pretext for the imposition of political nostrums. There was the demand for "security," growing out of the depths of the depression; there were the "ill-housed and the ill-fed." The Government came forward with one experiment after another to "fill the gap left in an economic system which private business failed to plug up." But now the Planning Board anticipates a new "emergency." It finds that transportation in America is about to "break down"—that financing from private sources will not be available after the war. This is a pure assumption to fit the recommendation. Only the Government itself can bring about such a set of conditions.

Without embellishment the Planning Board proposes a plain, outright Government ownership program.

Not a favorable word is to be found in over 500 pages of its Report in support of private ownership of this industry; not a mention of the rights of the investors, among whom are 60,000,000 life insurance policy holders and the depositors in our savings banks.

Let us not dismiss this recommendation lightly. It is a very real threat to the enterprise system. It fits in naturally with the plans of our "invisible government" at Washington.

Government Corporations

That our readers may glean some insight into the implications of the Planning Board's recommendations, let us briefly examine how the Federal Government is making use of the "corporation" method to exercise the full benefits of Government resources and power, yet circumventing the controls which are placed by Congress when granting Federal authority to Government departments. The proponents of deficit spending find the Government corporation the best tool for the purpose of whittling away and eventually destroying private industry. Almost without notice Bureaucracy can use these corporations to promote inflation (while politicians are giving lip service to its control); can pyramid the cost of Government at will; and can displace private enterprise wherever it stands in the way of the "planned" program.

The assets of Government corporations have increased 500% during the past ten years. As of January 31, 1943, the Government's proprietary interest in corporations amounted to $11,671,000,000, i.e., for those corporations which actually reported to the U. S. Treasury Department. (Some make no reports.) As of the same date, these reporting corporations had total assets of $23,199,000,000. Compare this with the total investment account of the railroads (America's largest industry) of about $26,000,000,000. It has taken a hundred years to build the railroad investment. It took only ten years to build this Government monopoly.

Twenty-six of these "corporations" had received funds from all sources as of January 1, 1943, of $35,129,000,000. As of June 30, 1939, the Secretary of the Treasury submitted a list of these agencies to the Senate, of which fourteen showed a net profit and eighteen showed a net loss from the time of their inception. The combined loss was $1,654,000,000. Moreover, these Government ventures loan money and thus expand control. Total loans as of January 31, 1943, were $8,086,000,000.

On June 30, 1939, twenty-eight of these agencies had 1814 field offices. A partial list shows the employment of 109,519 people and a monthly pay roll of $19,000,000. Add this to the 3,000,000 Federal civil service employees, and we have a fair picture of the Octopus of Bureaucracy which seeks to take over at the end of this war.

* From Monthly Letter No. 2 issued by the Transportation Association of America, Chicago, Ill., June, 1943.

DEFERMENT OF CERAMISTS

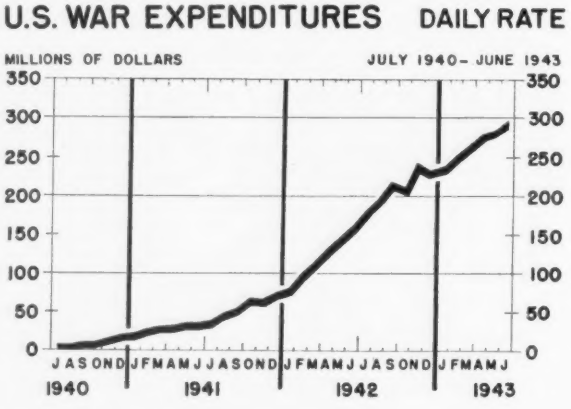
Our Public Relations Committee, under the Chairmanship of V. V. Kelsey, has been in contact with the War Manpower Commission relative to the inclusion of ceramic engineers and ceramic technologists in their various Occupational Bulletins.

He has given the following information: "On March 1, 1943, the National Headquarters of the Selective Service System issued Activity and Occupational Bulletin No. 22, Production of Stone, Clay, and Glass Products. Under 'Essential Activities' are included abrasives, heat insulation material, practically all glass products, crucibles, electrical porcelain, refractories, chemical lime, sand-lime brick, and heat-resisting clay products." Nothing is said about regular structural clay products.

Under "Essential Occupations," they now include ceramic engineers by name and they will be deferred upon request by their employers to the local draft boards. Mr. McNutt's office claims this also applies to ceramic technologists.

Mr. Kelsey is working with Commander Winston on the deferment of ceramic students.

—C. E. BALES, *President*



THAT KILGORE BILL ON SCIENCE MOBILIZATION*

A STATEMENT BY FORD W. HARRIS OF HARRIS, KIECH, FOSTER & HARRIS, LOS ANGELES, CALIF.

The Kilgore Bill

The Kilgore Bill sets up an Administrator with $200,000,000 under his absolute control. He is given absolute control over all scientific and technical facilities and all scientific and technical personnel without supervision or right of appeal. He not only has full control of this personnel, but he has absolute power to subpoena any persons the Administrator thinks know anything the Administrator wants to know, and, if they do not come at once and tell him what he wants to know, he can throw them in jail. He can seize any facility, which not only includes by definition the new RCA laboratory, but every student's microscope and test tube. The owner can either take what the Administrator offers for the facility, or he can sue the Government in the Court of Claims. Since the Government has not yet paid all the claims arising from the last war, this is cold comfort for an organization which has had all its scientific apparatus confiscated and which knows that if it replaces it the replacement units are also subject to confiscation.

As to personnel, the Administrator is given full control of the "training, classification, and employment of all scientific and technical personnel by any person, agency, or establishment, public or private," and this personnel includes everyone "excepting physicians and dentists . . . who has completed any course of study in any college or university in any branch of science or its practical application or who has had not less than an aggregate of six months' training or employment in any scientific or technical vocation."

RESOLUTION ON THE SCIENCE MOBILIZATION BILL (S. 702)*

American Association for Advancement of Science

There is now pending in the United States Senate the Kilgore Bill (S. 702), entitled "A bill to mobilize the scientific and technical resources of the Nation, to establish an Office of Scientific and Technical Mobilization, and for other purposes." This pending bill is so sweeping in character and will affect science and scientists in so many ways that it merits careful consideration by the American Association for the Advancement of Science. In examining the purposes and provisions of Bill S. 702 it will be convenient to follow the twelve sections into which it is divided and to point out which of the provisions are to be effective in time of peace as well as in time of war.

Section 1 recites, first, the reasons for the bill, effective both in time of war and in time of peace. In enumerating the "serious impediments" to the "full development and application of the Nation's scientific and technical resources," the bill uses such terms as "unassembled and uncoordinated state of information," "unplanned and improvident training, development, and use of scientific and technical personnel . . ," "delay and ineffectiveness in meeting urgent scientific and technical problems. . . ."

As to information about scientists, it is always available in the membership lists of scientific societies in every special field to a total of more than 500,000 names, in the membership list of the American Association for the Advancement of Science (25,000), in American Men of Science (28,000), and in National Roster of Scientific and Specialized Personnel (500,000). As to information about scientific work, scores of scientific journals covering together every important field of science are published regularly in the United States. Moreover, abstracts and reviews of practically all the current literature of the world are available in a number of such publications as *Biological Abstracts* and *Chemical Abstracts*, each of which publishes about 25,000 abstracts annually.

As to "delay and ineffectiveness in meeting urgent scientific and technical problems," in 1863, at the instance of scientists of the United States, the National Academy of Sciences was established by an act of Congress which provided that the Academy shall, without compensation, advise the Government on scientific questions, an obligation that the Academy has unfailingly fulfilled. The first World War began in August, 1914. Although President Wilson enjoined the citizens of the United States to remain strictly neutral in thoughts as well as in acts, in May, 1915, leading scientists of the country, realizing the nature of the storm in Europe, began to organize the scientists of the Nation for service to the Government on a more com-

* See also *Bull. Amer. Ceram. Soc.*, **22** [7] 260–61 (1943).

prehensive scale than could be provided under the limited membership of the Academy. In March, 1916, a year before this country entered the war, President Wilson established the National Research Council by Executive Order as an Agency of the National Academy of Sciences. It promptly effected an organization and prepared to respond to any calls the Government might make on scientists. The contributions of the National Research Council to the war in 1917–1918 and to the national welfare during all the intervening years to the present have been enormous. It is now serving the Government through about 200 committees composed of more than 1000 scientists. On June 28, 1941, President Roosevelt established by Executive Order the Office of Scientific Research and Development completely under the administration of scientists. It has formulated plans for research on war problems and entered into contracts with university, research organizations, and industrial laboratories which have entailed an expenditure of $188,000,000, all on a nonprofit basis. The products resulting from these researches have been ordered through regular Governmental channels under contracts amounting to $2,000,000,000. All this has been accomplished without discord, reorganization, or the necessity of executive intervention. In addition to these activities, the principal scientific societies have appointed special committees for the investigation of war and defense problems in their respective fields and through which Governmental agencies at any time can promptly obtain scientific information and competent personnel. In the face of such achievements the words "delay and ineffectiveness in meeting urgent scientific and technical problems" in Section 1 of S. 702 are not appropriate

Section 1 contains also a declaration of policy, using such terms as "appraise," "mobilize," "assemble," "coordinate," "promote," "aid," "encourage," "discover and develop substitutes," "promote interest in scientific and technical education," "provide guidance," "standardize," and "establish a national scientific and technical office." These words express worthy objectives. But these objectives have already been realized by science and technology to such an amazing degree that within a century living conditions have been more completely changed than in the preceding thousand years.

Section 2 defines terms used in the act. "Scientific and technical facilities shall include all real and personal property, . . . programs, projects, . . . methods, processes, procedures, . . . patents, inventions, . . . information or knowledge of every description used or intended to be used for scientific or technical purposes in research and development or in the production or supply of war or civilian goods or services." "Scientific and technical personnel shall include all persons, excepting physicians and dentists, who have completed any course of study in any college or university in any branch of science or its practical application or who have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." "Agency or establishment" means any Federal or State agency or other body or any "local government, person, firm, or partnership engaged in business for profit, or any corporation, profit or nonprofit, association, school, college, and university." In short, "scientific and technical facilities," as used in S. 702, includes every means useful in any way for the production of "war or civilian goods or services"; "scientific and technical personnel" includes every person, except physicians and dentists, who has completed a college course in any branch of science or who has been employed for six months on any kind of work that may be called technical; and "agency or establishment" includes every agency, corporation, person, partnership, association, school, college, and university, whether or not organized for profit and whatever its purposes or activities may be. It would be difficult to make more inclusive definitions. Moreover, in giving to an agency under the President powers over broadly general things the act violates the spirit of the Federal Constitution which grants powers over specific things to the Federal Government and declares that those not so delegated nor prohibited by it to the States "are reserved, respectively, to the States or the people."

Section 3 defines the organization of the "Office of Scientific and Technical Mobilization." It is to be under the direction of an "Administrator," appointed by the President to serve at the pleasure of the President, and of a salaried "National Scientific and Technical Board," also appointed by the President, but whose duties are to be defined by the administrator. This board is to consist of six members, besides the administrator, one to represent industry, one to represent agriculture, one to represent labor, one to represent the consuming public, and "two additional members at large who shall be scientists or technologists." By previous definition in the Bill, to be classed as a scientist or a technologist it is sufficient to "have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." The administrator will appoint all other employees, and he may waive the provisions of the civil service laws and regulations if he determines it is necessary to do so.

Provision is made also for a nonsalaried "National Scientific and Technical Committee," consisting of the board previously mentioned, a representative from each of such Federal departments as the President shall designate, four additional representatives of the consuming public, six additional members representing labor, six representing management (including small business), and three additional scientists or technologists. That is, the Technical Committee will consist of twenty-five to thirty members, of which five must be scientists or technologists in the sense that each of them shall "have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." This committee is to be appointed by the President to advise and consult with the administrator at least once a month upon basic policies of the board.

In order that it might reasonably be hoped that any considerable fraction of the purposes of the act, as set forth in the latter part of Section 1, might be realized it would be necessary that the administrator and the board be men of the highest integrity, ability, experience in science, and devotion to public welfare. Instead of insuring that the board shall have these essential qualities the act provides for a primarily political board of seven members, only five of whom need be scientists or technologists even in the extraordinary sense in which the term "scientific and technical personnel" is defined in Section 2.

Section 4 defines the powers of the proposed office, effective in times of peace and of war. Blanket authority is given for many purposes, including the powers to formulate, finance, control, contract for, and operate all undertakings or projects that the administrator shall determine fall under the broadly inclusive definitions of "scientific and technical facilities," "scientific and technical personnel," and "agency or establishment" previously given. This section explicitly provides that these sweeping powers are to be exercised in accordance with rules and regulations prescribed by the administrator and that they "shall have the force and effect of law" of Congress. That is, in passing this act the Congress would delegate to the administrator appointed by the President lawmaking powers, relative to this subject, that are vested, in general, in the Congress by the Constitution of the United States.

Section 5 transfers to the administrator, by amending the Selective Training and Service Act of 1940, control over the deferment from military service of persons who, under the definitions of the act, are classed as "scientific and technical personnel." In view of the inclusive definition of "scientific and technical personnel," this provision would seriously impair the functioning of the already complex manpower control machinery.

Section 6 gives the administrator, in time of war, the right to requisition, subject only to review by the President, the stupendous means of production that, under the act, are classified as "scientific and technical facilities," and to represent before the War Production Board "any application for allocation of, and priority for, any critical

material and equipment in scientific and technical research and development." The exercise of such a power would severely handicap the functioning of such efficiently managed and highly successful agencies as the Office of Scientific Research and Development, referred to in comments on Section 1.

Section 7, "any provision of law to the contrary notwithstanding," vests the office with "the exclusive right to use, and with the exclusive right to license others to use (1) any invention, discovery, patent, or patent right which has heretofore resulted, or shall hereafter result, from research or invention for the carrying on of which the United States or any department, agency, or establishment thereof either has heretofore contributed at any time since the declaration of national emergency on May 27, 1941, or shall hereafter contribute any money, credit, physical facilities, or personnel; and (2) any invention, discovery, patent, or patent right which is at the time of the enactment of this act, or shall hereafter become, to any extent the property of the United States or of any department, agency, or establishment thereof." These broad powers are vested in the office, however small the contribution by the Government or a Governmental agency may have been. The administrator is "authorized and directed to prescribe and promulgate rules and regulations which shall thereupon have the force and effect of law for the enforcement of the provisions of this section, ..." This delegation of power giving the office the exclusive right to use patents and to license others to use them opens the door to abuse in time of peace and adds nothing to the powers of the Government in time of war.

Section 8 gives the administrator the power to require all information he may desire "concerning scientific and technical facilities during the existence of a state of war and concerning scientific and technical personnel at all times." "Any person or establishment [possibly a university] refusing or wilfully failing to furnish the . . . shall, upon conviction thereof, be fined not more than $5000 or imprisoned for not more than one year, or both."

Section 9 authorizes the appropriation of $200,000,000 to carry out the provisions and purposes of the act. This section also authorizes the administrator to organize corporations and to make loans to, or purchase all or part of the capital stock of, corporations whenever he deems it necessary to do so for the more effective exercise and performance of his own powers and duties or of those of the office. The appropriation provided would be wholly inadequate for the purposes set forth.

Section 10 gives the administrator important powers usually lodged in courts, and it provides that "any person who wilfully violates any order, rule, or regulation promulgated by the administrator under the authority of this act shall, upon conviction thereof, be fined not more than $5000 or imprisoned for not more than one year, or both." In giving the administrator, a representative of the President, quasijudicial powers the act departs from the distribution of legislative, executive, and judicial powers as defined in the Constitution of the United States.

Section 11 requires the administrator to render annually to the President and to Congress a written report, summarizing the activities of the office and the status and progress of science affecting the public interest.

Section 12 provides that if any clause, sentence, or paragraph of the act is invalidated by any court action it shall not affect the validity of the remainder of the act.

After careful consideration of the purposes and provisions of the Science Mobilization Bill (S. 702), the American Association for the Advancement of Science, an organization having nearly 25,000 members (and having 187 associated and affiliated societies with a combined membership of over 500,000 persons whose interests cover broadly all the natural and social sciences) now, through its Council of about 250 members chosen from among the leaders of American science, respectfully recommends to the Senate and to the House of Representatives of the United States that the Kilgore Bill (S. 702) be not passed either in its present form or in any other form containing similar provisions.

All Americans Are and Will Sacrifice for Successful War Prosecution, But They Will Not Sacrifice Their Democratic Ideologies for Postwar Governmental Controls.

CERAMIC VICTORY RESOURCES

RAW MATERIALS*

By John R. Hostetter

Abstract

A short résumé is given of the functions of the Glass Unit of the War Production Board, with particular reference to the supply situation of raw materials used in the manufacture of glass.

I. Introduction

The Glass Unit of the War Production Board was formed in January, 1943, when the Chemicals Division of the War Production Board assumed jurisdiction of flat glass, consumer items, and industrial glassware. This Unit supervises the distribution of raw materials for the production of all types of glass commodities, with the exception of optical, ophthalmic, and fiber glass and glass containers. Although it may seem strange that these activities are centered in the Chemicals Division, one example should help clarify this matter. In the third quarter of 1942, glass companies' needs and problems were scattered among eleven different units or sections of the War Production Board, and this did not help so far as the industry was concerned. By concentrating the problems of glass companies in several Sections as it is today, the industry has three focal points, namely, the Containers Division, Fiber Glass in the Cork, Asbestos, Fibrous Glass Division, and the Glass Unit of the Inorganic Section.

II. Glass Production

The glass industry is a large, important industry. Last year's products were valued at $485,000,000. At least

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943 (Glass Division). Received April 20, 1943.

half of this total represented glass containers. As of June, 1942, there were in operation 202 pot-furnaces, 282 day-tanks, and 610 continuous melting units. The annual production of finished products at the June, 1942, rate of operation was 5,203,196 short tons. Since June of last year, there have been a number of changes in different types of glass manufactured, so that this tonnage figure cannot be classed as accurate. Calculated on the basis of continuous operation, however, with time out for necessary repairs and maintenance, and, of course, assuming that sufficient raw materials, labor, and fuel are forthcoming, the potential annual capacity of equipment, based on the estimated potential capacity of melting and finishing equipment, as of June, 1942, is 6,522,184 short tons.

For the calendar year of 1941, a total of 4,853,575 short tons of finished glass was produced. The tonnage of some of the raw materials consumed was as follows: sodium nitrate 10,959, salt cake 48,000, sand 3,131,788, soda ash 1,056,000, lime and limestone 630,341, borax and boric acid 30,492, own and foreign cullet 1,641,589, and potassium carbonate 5000, making a total of 6,554,169 short tons.

Last fall, the use of arsenic was restricted, but the glass companies were permitted to use supplies until the end of the year. Sufficient warning had been given to the industry that arsenic had to be eliminated from all nonessential glass. Antimony oxide, although not a universal substitute for arsenic, was made available to the entire industry if they could use the material. This proved to be better than nothing at all, provided that the glassmen wanted it and had enough patience to work with it.

Although most of the basic raw materials in the glass batch have no restrictions on end-use, some are restricted or are under complete allocation. These restricted and allocated materials, although not handled by the Glass Unit, represent a problem in determining their essentiality, substitution if possible, and elimination. Of all the materials that are used in glass and are allocated or restricted, every attempt is made to supply the materials if they are for an essential purpose. The Glass Unit has no restrictive orders or directives on types of glass produced, but has suggested and recommended to individuals in the industry that useful types of glass be manufactured and novelties and knicknacks be eliminated as soon as possible. This is sometimes a hardship, but it is a necessity.

III. Raw Materials on Hand

(1) Arsenic

The demand for arsenic for direct military purposes and for agricultural insecticides has strained the supply to the point where the Glass Unit is obliged to weigh carefully every request for arsenic, especially those requests for uses other than direct military and agricultural purposes.

The glass companies as a whole have cooperated graciously with the war program in relinquishing their arsenic stocks and are making every effort to apply substitutes. In many cases, the arsenic restriction has presented hardships which have been recognized, yet it has been necessary to deny the use of commercial arsenic except in extreme cases or for the manufacture of certain types of glass.

It had been hoped that there would be an improvement in the arsenic supply situation to permit relaxation of restrictions to some extent, but the immediate future does not look promising. The Glass Unit is most sympathetic to the requirements of the glass manufacturers for materials which in most cases are necessary to produce a satisfactory and acceptable product, and, whenever possible, it will be glad to lend assistance in procuring substitutes for arsenic or residuals containing arsenic which are not generally considered commercially acceptable.

(2) Cobalt

On a basis of 1942 requests and allocations, there is at the present time approximately a six-month supply of cobalt in metal and crudes. The cobalt order has been amended to remove all restrictions as to use so that if the requirements of cobalt are not excessive, the Glass Unit will be able to release some of this material for color and other uses which were formerly prohibited.

During the month of March, the demands for cobalt rose so sharply that it has been somewhat disturbing. On the basis of returns up to date, it has been impossible to obtain a really good picture of the amount requested for the month of April. In the course of another month, requirement figures from the Army, Navy, and Civilian Supply will be available, and the Glass Unit will be in a position to give a better picture of the probable supply situation than at this time. In the meantime, it is trying to release some metal for use in the ceramic and glass industries. At present, however, the use of cobalt should be confined to the most essential uses and no new programs which would require larger quantities of this metal should be formulated.

(3) Fluorspar

The ceramic grade of fluorspar, a finely ground product, is used primarily as an opacifier and flux in the glass industry and as a part of the frit in the enamel industry. As the ceramic grade, however, can be used in electric-furnace operations, the substitution of this material for standard metallurgical grade is urged. In general, gravel material is essential wherever there is a draft. As there is no draft in the electric furnace, there seems to be no reason why electric-furnace operators cannot use the ceramic grade.

A small quantity of ceramic material is produced by grinding subacid-grade material. The specifications vary widely, but the standard is 95% CaF_2 minimum and $2^1/_2$% SiO_2 maximum. Partial substitution of sodium silicofluoride is possible, but the glass industry is already using substantial quantities of this material, and further substitution would increase their costs and reduce quality. Much of the glass and enamel produced by this method is being used directly in the war effort, and a conservation order would yield little.

The supply of ceramic-grade feldspar exceeded the requirements of the ceramic industry by 10,000 tons in 1942, but only a part of this excess found its way into stocks. The rest was used by metallurgical, acid, and other consumers. Mines producing this grade also produce the metallurgical and acid grades.

Stocks of the ceramic grade of fluorspar on January 1, 1943, were 11,427 tons in addition to 471 tons in transit.

At the beginning of the year there were 10,418 tons in stock. A projection of the rate of consumption during the last half of 1942 indicates that 1943 requirements of the ceramic and glass industries will be from 18,000 to 20,000 tons. There has been no indication of an increase in use, and as stocks and the rate of supply are adequate, no company-by-company survey of 1943 requirements of this grade has been made.

(4) Nitrate of Soda

Agriculture accounts for the largest requirement for nitrate of soda, and this use is extremely essential in the food-production program. The demand is at its peak during the spring months through June.

As it is impossible to supply agricultural requirements in full, industrial uses which are deemed less essential are denied supplies. No requests for allocations of nitrate for use in the manufacture of glass containers or glass tumblers used for containers have been allowed, as these glass items can be manufactured without the use of nitrate of soda.*

The War Production Board wishes that all glass manufacturers would continue to keep their consumption of nitrate of soda to a minimum, even for those purposes for which supplies are allowed, e.g., table and art glassware. Although even these items could be manufactured without the use of nitrate of soda, in view of the war situation, it would probably result in putting numerous manufacturers of these items out of business. It has, therefore, been the policy of the Glass Unit to permit the use of nitrate of soda for the manufacture of art and table glassware, but the success of this policy will depend entirely on the degree of cooperation received from the industry in keeping down their requirements to a bare minimum.

Requirements of nitrate of soda for essential types of technical glassware are being allowed in full, and the Unit continues to ask the cooperation of the industry not to use more nitrate of soda for such purposes than is absolutely necessary. Of all the industrial uses for which allocations were approved during the past year, glass alone has greatly exceeded estimates based on past consumption.

With the exception of technical glassware, most other uses of nitrate of soda are more essential than the manufacture of glass, and it is hoped that the glass industry will see to it that all consumption of this chemical be kept at a minimum. Shortages of nitrate of soda are expected to continue for an indefinite period, because this country depends on imports to such a large extent for its over all supply. Actually, the situation is apt to become much worse as time goes on.

(5) Natural Gas

The growing demand of prime war consumers for natural gas created a critical situation in many parts of the country during the midwinter months just passed. The glass plants making containers and flat glass have been curtailed for short periods. In carrying out the curtailment schedules, paragraph (*c*) of Limitation Order L-31 has been followed closely. The prime war producers are the last plants to be curtailed after all other consumers purchasing gas on interruptible contracts and with standby facilities have been curtailed to the extent of such facilities.

Glass tanks usually do not have standby fuel facilities, and no glass producer has been curtailed as yet beyond the point where permanent damage to tanks would result. In general, approximately 60% of the normal fuel requirements of a tank is needed to hold the glass in a molten state.

The loads on most of the pipe-line systems in the critical areas are still increasing, and it is anticipated that by next winter they will have reached a point where curtailment of glass plants and other industries will occur more frequently. At times it may be impossible to guarantee even the minimum "holding" requirements without losing prime war production. The areas which are considered to be the most critical are Southern California, Eastern Kansas, Missouri, Eastern Nebraska, Iowa, Minnesota, Illinois, Indiana, Ohio, Pennsylvania, New York, and Michigan. To avoid loss of production, it is suggested that container and flat-glass plants consider conversion to producer gas whenever possible or install supplemental facilities. Some plants may have old producer-gas generators which can be reconditioned. In any event, the question of obtaining sufficient heating units for operation and to prevent damage to glass tanks should be considered.

Acknowledgment

The writer wishes to thank the different members of the War Production Board who contributed material for this paper.

Glass Unit, Inorganic Chemicals Section
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Washington, D. C.

* The Nitrogen Unit, WPB, on May 28, 1943, further directed that after June 30, 1943, no sodium nitrate or potassium nitrate would be allocated for use in making any type of glass and glassware melted in continuous tank furnaces and formed on automatic machines, excluding borosilicate glasses and lead tubing.

WESTERN TALCS*

By W. Wallace Roff

Abstract

Current information is presented on western talcs, including those now being produced in California, Nevada, and Montana.

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I. Introduction

Talc from the western part of the United States is playing an important part in our war program. This nonmetallic mineral is strategic, for without it we would be unable

to produce certain types of ceramics, particularly high-frequency insulators, needed in our war effort. The talc used in the manufacture of these insulators originates principally in our western states, and the selected quality produced in these mines is reserved almost exclusively for this purpose.

Western talc deposits are located in the states of California, Nevada, Montana, New Mexico, and Washington. There are other deposits in other western states but none are producing on a large scale.

II. Types of Western Talc

There are five principal types of western talc, the first three of which, viz., steatite, foliated, and massive talc, have similar characteristics insofar as chemical analysis and application is concerned. The other two types, viz., tremolitic and fibrous talc, differ from the foregoing because of their crystalline or fibrous structure and chemical analysis.

Common usage of the term "steatite" in industry is misleading at times, because this name is applied on the one hand to a specific grade of talc and on the other to a finished manufactured product. In this discussion, the name "steatite" is confined to a general grade of talc which, for all practical purposes, covers the first three classes of talc, viz., steatite, foliated, and massive talc.

The steatite talcs prove their value to industry because of (1) their chemical analysis, (2) the ease with which they may be machined or tooled, and (3) their performance in extrusion or various fabricating operations.

The lava steatite talc differs from the powdered form in that the former lends itself to machining, whereas the latter responds to extruding, pressing, and firing.

Lava steatite talc is not found in great abundance in this country. It is fortunate, therefore, that industry has adopted itself to more common usage of the powdered steatite which is plentiful, particularly today when Government restrictions against unlimited use for cosmetic and other products not essential to our war effort leave a sufficient supply available for essential war products.

Reverting to the other grades of talc, just to distinguish them from the steatite group, the tremolitic and the fibrous types are recognized by the crystalline particles or short fibers found in them.

The western tremolitic talc in normal times is used in large quantities by the ceramic industry, especially in wall tile and dinnerware. Western fibrous talc is used generally in the paint industry.

III. Extent of Talc Production

California is the pioneer in western talc production, operations having started there in 1893, but until 1912 production was intermittent. Over these years of continued production the output has developed from 1700 tons to 36,000 tons for 1940. Current figures are not available, but it can be assumed that, with imports practically at a standstill and the increased demand for quality material, 1943 will be a banner year in western United States talc production.

IV. Location of Talc Mines

The California talc mines are located in the southern half of the State. The names, Talc City, Alliance, Thomas, White Mountain, Excelsior, and Trinity, represent outstanding producing mines. There are many other mines, however, which contribute to the large supply of the numerous grades of talc available in this State. Deposits are found at elevations ranging from 500 to 9000 ft. The qualities produced vary in color, texture, chemical analysis, and physical structure. Usually one mine will produce more than one grade of ore and therefore careful selection of crude ore is necessary.

The talc mines of California can be classified into three groups, viz., low-, intermediate-, and high-lime talc.

California low-lime talc mines are located east of Keeler and in the Saline Valley. The talc mined here contains from $^1/_2$ to 2% lime.

The California intermediate- and high-lime talc district is located at the southern end of and east of the Death Valley National Monument. The lime content of run-of-mine talc coming from this area varies from 4 to 18%.

The Nevada talc mines are located near the California State line east of Oasis, California. Deposits represented and producing considerable tonnage are Reed, Oasis, McBoyle, Rosamelia, and Cheroty. There are various other mines producing in Nevada and, like California, the qualities vary and the careful selection of ore is essential.

Montana talc mines are located south of Butte and west of Yellowstone National Park. Madison and Smith-Dillon mines are pioneer operations in Montana. These mines are now supplying large tonnages of talc for ceramic purposes, some suitable for machining. Talc from this State suitable for lava insulators is the only satisfactory grade of steatite variety found in the United States at this time to substitute for grades coming from India and Europe. Many tons must be mined to produce a small quantity of satisfactory steatite talc for lava insulator purposes. This requires skilled mining and blasting.

Most of the talc, however, is unsuitable for lava insulators and is ground for use in pressed or extruded ceramic ware. Recent tests have shown that talc coming from this area has good electrical properties and has a soft character which causes less die wear. Like California and Nevada, careful selection of ore is important, as each mine produces various grades.

New Mexico mines are in operation and are producing talc for ceramic and other purposes. No steatite grade is available as yet for machining, but considerable quantities are being ground for manufacturing insulators and other products. The talc is low lime, usually under 2%. New Mexico deposits are located in the Himbrillo Canyon near Engle, New Mexico.

V. Mining and Grinding Procedure

Commercial western talc deposits are generally found in lenses or kidneys and frequently there are large lime boulders and masses of greenstone and other waste that must be removed before mining operations can progress. In some cases, mines are opened by cutting directly into the outcropping of talc. When this method is employed, the mine tunnel is run directly into the talc body, and careful timbering is necessary. Talc is a slippery material and, because of this very characteristic, will slide or break off in large sections. With this characteristic in mind, the operators of talc mines proceed with their cutting and

routing by leaving sturdy pillars of talc at various points to prevent uncontrolled slides. This insures the mine against cave-in, whereby large quantities of high-grade ore are lost. Frequent crosscuts are made to determine the extent of the deposit and to ascertain the quality of the ore, the grade usually improving as the mining progresses. Contamination from surface seepage generally disappears at depth.

Frequently a shaft has to be sunk directly into the deposit and the main tunnel run from this shaft into the talc ore. The depth of the shaft will be varied to suit conditions. Within this procedure, it is necessary to hoist the ore to the surface, which adds considerably to the cost.

To convey talc to the mine portal, small mine cars are used which operate on steel rails that are laid in the mine as operations move forward. The cars carry up to 2000 lb. or more, and move in single units by man power. Miners usually wear heavy toe-protected shoes and use fabricated safety helmets to which they can attach carbide lamps. Unlike coal mines, the talc mines are free of gases so that open-flame head lamps can be used with safety. Tracks in the mine lead to either storage bins or refuse piles for discarded material. If hoisting is necessary, tracks are laid to the hoisting equipment. Great care is used in sorting the rock, not only when it is mined, but also before it is delivered to the trucks for shipment to the grinding mill. At some mines, it is run over a grizzly screen or hand-sorted to remove the fines which usually carry a large percentage of the impurities, particularly lime. A grizzly is made of steel bars, about $^3/_4$ in. wide, 2 in. deep, 5 or 6 ft. long, and as wide as the chute, usually 12 to 18 in. The space between the bars ($^3/_4$ in.) permits the fine material to drop through.

As the ore passes over the grizzly it continues down the chute to the hand-sorting tables. Careful inspection is made by men and now, owing to shortage of labor, also by women, who can determine the grade and quality of the ore by sight or touch, and then it is passed along to the proper storage bins. Usually a deposit will produce more than one grade of ore. Occasionally pieces that are questionable as to grade are rubbed against the top of the metal sorting tables to determine the type of ore.

Some mines are so located that there are good roads to their storage bins, and large trucks and trailers move directly to the bins for loading. In many instances, however, the mines are far from good highways, and the talc has to be moved by small trucks from the mine to bins located on roads that can accommodate heavy trucking. Large trucks then carry the ore directly to the grinding mills or railroad cars.

Upon arrival at the various grinding mills, the talc is dumped into storage bins or passed directly to further hand-sorting tables to check the quality of the ore before milling. Laboratory samples of ore are taken; this sampling procedure is also followed at regular intervals during grinding operations. The ore then moves to the crushers to reduce it to a uniform size (about $^3/_4$ in. or less). It is then conveyed to small storage hoppers and from there it is fed directly to pulverizers that produce powdered talc to meet the requirements of industry.

Here the talc is fed automatically to the mill, and the ground material is carried in an air stream to separators. Talc that is coarse and requires regrinding is automatically returned to the pulverizers. Ground talc of proper fineness drops into hoppers above the bagging equipment, and the very fine material passes along to be collected in finely woven cloth containers suspended from the ceiling in the millroom. Bagging equipment is so arranged that the talc is fed into paper bags, usually 50 lb. each, and is automatically weighed and sealed. It is then properly marked as to grade, and stored, or placed in railcars or trucks to be dispatched to various plants or points of distribution.

VI. Demands of Industry

Each industry demands that the talc it uses have certain characteristics. Purity, color, slip, or texture usually determines the quality desired. For example, different grades of talc must be blended for wall-tile manufacturers than those blended for dinnerware producers. Likewise, insulator manufacturers need a grade with entirely different characteristics and specifications than the paint trade. Mines contain ore of different qualities; blends of varying grades, therefore, can be made to produce results to conform to specifications set by the user. This requires careful supervision at the grinding plant. Automatic machinery mixes and weighs the various ores before they are run through the grinding equipment. A careful check is made every few minutes to see that the color, grade, and fineness are up to standard. This practice is employed on all grades produced, whether blended or straight ores are used.

By blending, many grades of talc are available and usually, if a special grade is desired, the talc miller can produce the exact grade to meet the specifications.

The ceramic industry has the problem of shrinkage control. To assist in overcoming this difficulty, several grades of calcined talc have been developed. One type is made from low-lime talc and another from talc containing approximately 4% lime. Calcining methods are under rigid control by the talc producers, and the products are carefully prepared to insure uniformity. Calcined talc is usually ground to approximately 200-mesh. Talc of this character increases wear on the dies, and special grinding methods are used to help overcome this disadvantage. This grinding or fine pulverizing is accomplished in special mills which use superheated steam or compressed air. The calcined talc ground in this fashion can be reduced to 500- to 1000-mesh or better, thus cutting down appreciably on die replacement.

Other industries, too, require talc of fine particle size, and the special equipment previously mentioned has developed new types. This processing has resulted in increased production, saving in time, and, in many instances, has opened the door to a great number of new uses.

Beneficiating high-lime western talc by acid-washing is being considered. Pilot plant productions have been tried in the manufacture of ceramic insulator ware with favorable results. No large tonnages, however, are available at this time.

Exploration work and laboratory research are now being carried on by engineers and chemists, and new mines and new uses for western talc undoubtedly will be uncovered.

VII. Conclusions

(1) Western talc is available in sufficient abundance to meet the ever-growing demand of our war effort.

(2) Western talc is available in various grades to meet the particular requirements of individual industries.

(3) Western talc producers have shown an alertness to the peculiar features of the ceramic industry so that essential changes are made effective in their operations to supply the right material for each job.

(4) Further progress can be made between western talc producers and talc users by a mutual understanding of each other's needs and limitations.

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NEW YORK, N. Y.

CANADIAN TALC FOR USE IN STEATITE INSULATORS*

BY H. S. SPENCE, J. G. PHILLIPS, AND W. T. TURRALL

ABSTRACT

Talc of good white color has been mined and milled at Madoc, Hastings County, Ontario, for nearly forty years. The deposits, nature of the ore, and mining and milling methods are described. Flotation tests on Madoc talc conducted in the laboratories of the Canadian Bureau of Mines have indicated that beneficiation methods may be applied to produce talc of high purity. The test procedure is described, and results are given, together with an analysis of the final product. Tests made to determine the suitability of beneficiated Madoc talc for use in high-frequency electrical insulators have shown that (1) it is soft and nonabrasive, (2) it is slightly more refractory than some steatite-insulator grades of talc in use, (3) it fires to a pure white color, and (4) the dielectric properties to be expected in bodies prepared from it may be comparable to bodies obtained with other talcs currently being used for the manufacture of steatite insulators.

I. History

The talc deposits of the Madoc district, Hastings County, in Eastern Ontario, constitute the only important known Canadian occurrence of prime white talc. These deposits have produced probably over 90% of the total talc output of Canada.

Their initial development began about 1900 with the opening of the Henderson mine close to the town of Madoc, and for some years several hundred tons of crude talc were shipped annually to the United States for grinding. In 1906, the George H. Gillespie Company erected a mill at Madoc station to grind ore from the Henderson mine, and subsequently two other mills came into operation, one on the adjoining Conley property and the other at the village of Eldorado, a few miles north.

The Eldorado operation was intermittent and comparatively short-lived and was finally closed down in 1920. Although in general of similar character to that of the Madoc district proper, the Eldorado ore contained a considerable amount of free quartz, both in the form of disseminated grains and thin stringers and veinlets, and carried a far lower proportion of talc to dolomite, thus yielding an inferior grade of mill product.

The Conley mine, opened in 1912, has continued in steady operation under various organizations, the last of which, Canada Talc, Ltd., was formed in 1937. At that time, the Henderson mine and Gillespie mill were taken over and were merged under Canada Talc management, thus bringing, as at present, practically the entire Madoc talc industry under the one Company.

II. Deposits and Mining

The Conley and Henderson mines, although originally opened as separate properties, adjoin one another, and since the amalgamation in 1937 have been joined up by a safety and ventilation level. They still continue, however, to be operated as separate mines with individual hoisting; the Henderson ore is trucked to either the Gillespie or Conley mill, as demand warrants.

The Henderson shaft lies approximately 650 ft. west of the Conley shaft. Both mines have been working a series of east-west trending talc veins or lenses 5 to 65 ft. wide and with a proved over-all length of approximately 1500 ft. The thickest section lies to the west, where a single massive vein which seems to split up eastward into a number of diverging thinner veins has been worked. Post-ore faulting and crumpling of the formation have caused the ore-bodies to follow a somewhat erratic course, with numerous swings away from the main east-west strike.

Veins have been worked to a depth of about 400 ft., with seven levels opened. Shrinkage stoping is practiced; mill-feed drawn from reserves of broken ore is kept in the stopes. The total combined production of the Henderson and Conley mines, from the inception of operations to date, is estimated at approximately 400,000 tons. Present reserves to the proved depth are probably sufficient for another 25 years of operation at the present milling rate of 12,000 to 15,000 tons per annum.

III. Nature of Ore

The Madoc talc bodies are enclosed in white crystalline dolomite, or dolomitic limestone, of the Grenville-Hastings (Pre-Cambrian) formation; the talc is presumed to be an alteration product of original dolomite.

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The talc is of two types which occur without any special localization and may be either associated or separate.

Type 1 is a relatively hard pale greenish-yellow, massive, and compact steatitic talc with no visible grain or texture and with a splintery, uneven fracture. It resembles serpentine rather than talc in outward appearance and general physical character and occurs in narrow bands up to 3 in. wide, usually interbanded with a dense, fine-grained white dolomite or limestone with which it forms tight, intimate contacts. These contacts are so tenacious that recovery of clean talc by cobbing methods is impracticable, and even coarse crushing does not effect any material liberation. Such massive talc is comparatively pure, with little enclosed or intergrown dolomite or other minerals. It yields a snow-white powder, but owing to its hardness it tends to make a gritty ground product in sizes down to 325-mesh.

Type 2 is a white-to-pale cream-colored, soft, foliated talc of medium to fairly coarse texture. When freed of associated dolomite, it yields a prime white talc unsurpassed for color and slip. It occurs both in the form of a talc-dolomite rock, which is an intimate intergrowth of these two minerals, and as thin seams or bands on joints, shears, or slips in or adjacent to such rock.

IV. Milling

Although a small proportion of relatively high-talc crude ore might conceivably be secured by selective mining, cobbing, and picking, no such procedure is followed in actual practice, and no attempt to supply any specially pure grade of product such as might perhaps meet the specifications of higher-priced talcums and cosmetics has ever been made.

In general, the average run-of-mine ore goes to the mill without any attempt at segregation; for certain limited trades, however, mill runs may be made on ore selected for special characteristics. For instance, for ceramic use, an attempt is made by using high-talc crude ore to keep the lime content of the product down to 8%, whereas, at the other extreme, the roofing trade is satisfied with what may be mainly dolomite smeared or coated with talc.

Grades of product sold, therefore, have represented mainly variations in mesh fineness; the great bulk of the material is of approximately similar character and chemical composition and subject only to such variations as might arise through differences in the nature of the crude at different levels or from different mine sections.

Milling procedure at the two mills follows standard practice. Crude ore is broken first in a jaw crusher, followed in the one case by a rotary crusher which reduces to $^1/_2$ in. and in the other by a Griffin mill equipped with a screen passing 10-mesh. Grinding is by silex-lined tube mills in closed circuit with Sturtevant or Gayco air separators. Finished products are sold under a variety of brands according to mesh fineness and trade use, as follows:

"Fire-blown" 95%−400-mesh; 2S 95%−325-mesh; 2 97%−200-mesh; 1SS 97%−150-mesh; 0 97%−125-mesh; 3A 97%−100-mesh; and "Sand"−40- + 150-mesh.

V. Beneficiation

With sales outlets consistently equalling or surpassing mill capacity, none of the Madoc operators have ever felt impelled to make capital outlay for equipment to raise the grade of product materially, even though, in view of the prime white color and negligible iron content of the talc, the enhanced prices obtainable might well have seemed to warrant such a step.

In 1932, Carnochan and Rogers[1] undertook flotation and other beneficiation tests on a sample of Madoc talc in the Bureau of Mines laboratories at Ottawa and succeeded in lowering the lime (CaO) content from 5.7% in the crude ore to 0.32% in a flotation concentrate. They reported, however, that the product lacked the slip of a standard cosmetic talc. This may have been due to an excess of the hard, massive type of talc previously noted, which requires fine grinding to overcome grittiness.

No further test work was done on Madoc talc in the Bureau laboratories until 1942, when a shortage of suitable low-lime and low-iron steatite for electric insulators threatened American manufacturers and a supply of similar material for a new Canadian insulator plant became necessary. Accordingly, in June, 1942, a sample of run-of-mine talc was secured from Canada Talc, Ltd., for preliminary testing. This sample was cobbed and hand-sorted into two lots, viz., lot No. 1, high grade, and lot No. 2, low grade. The high grade represented 22% of the sample and contained 1.72% of CaO. The remaining portion or low grade contained 10.28% of CaO, thereby indicating that by meticulous sorting a useful separation could be made.

Each of the lots was crushed to −14-mesh, and representative 1000-gm. samples ground wet in an Abbé mill for 30 min. yielded a product of which 90% passed 200-mesh.

Laboratory flotation trials were made, and best results were obtained when pine oil and sodium carbonate were used as reagents. (The amounts used were 0.15 lb. per ton and 0.75 lb. per ton, respectively, for the high grade, and 0.15 lb. per ton and 1.5 lb. per ton for the low grade.) The high-grade talc concentrate required one cleaning and the low-grade talc concentrate required two cleanings to reduce the lime content to the desired tolerance.

Table I, for the high-grade talc, shows the weight recovery of talc product, CaO content, and the percentage distribution of CaO in the various products.

Table II shows similar data for results obtained when treating the low-grade talc.

These preliminary tests indicate that beneficiation by flotation of both selected high-grade and low-grade Madoc

TABLE I

RESULTS OF FLOTATION TEST ON HIGH-GRADE MADOC TALC

Product	Weight (%)	Analysis		Distribution (%)	
		Soluble CaO	Total CaO	Soluble CaO	Total CaO
Concentrate	52.3	0.18	0.35	6.2	10.6
Middling	24.5	1.30	1.58	21.0	22.2
Tails	23.2	4.74	4.98	72.8	67.2
Calculated feed	100.0	1.51	1.72	100.0	100.0

[1] R. H. Carnochan and R. A. Rogers, "Investigations in Ore Dressing and Metallurgy, 1932," *Can. Dept. Mines, Mines Branch Rept.*, No. 736, pp. 231–34 (1934).

TABLE II

RESULTS OF FLOTATION TEST ON LOW-GRADE MADOC TALC

Product	Weight (%)	Analysis: Soluble CaO	Analysis: Total CaO	Distribution (%): Soluble CaO	Distribution (%): Total CaO
Concentrate	17.4	0.42	0.56	0.8	0.9
Second middling	11.2	1.42	1.85	1.7	2.0
First middling	19.5	4.43	5.48	9.3	10.4
Tails	50.9	16.03	17.50	88.2	86.7
Calculated feed	100.0	9.26	10.28	100.0	100.0

talc will produce a satisfactory product for use in steatite bodies.

To produce a larger quantity of talc for submittal to firms engaged in steatite manufacture, a ton sample of talc was procured from Canada Talc, Ltd., in November. This sample, representative of the regular mill feed, had been dry-ground and air-separated at the mine. Although classed as −150-mesh, actually 97.5% passed 200-mesh. Such material was employed for test to determine whether installed grinding equipment could be utilized if plant extension to produce a steatite grade should be undertaken.

Two preliminary mill runs were made before a flowsheet was selected. The circuit consisted of a constant weight feeder, two conditioning tanks in series, five roughing cells, two cells for first cleaning (split feed), and one cell for second or final cleaning. Reagents used were pine oil (0.173 lb. per ton added to Nos. 1 and 3 rougher cells) and Na_2CO_3 (1.5 lb. per ton added to No. 1 conditioner). The feed-rate during the run was 48 lb. per hour, and the density in the rougher feed was maintained at 17% solids.

The results of the mill run are shown in Table III.

TABLE III

Product	Weight (%)	Analysis: Soluble CaO	Analysis: Total CaO	Distribution (%): Soluble CaO	Distribution (%): Total CaO
Concentrate	25.8	1.51	1.76	4.8	5.3
Second middling	13.0	4.87	5.04	7.8	7.7
First middling	20.8	7.60	8.03	19.7	19.8
Tails	40.4	13.41	13.91	67.7	67.2
Calculated feed	100.0	8.00	8.38	100.0	100.0

These results show that a talc product can be produced with a CaO content of 1.76% and a recovery by weight of 25.8% of the original sample. Further cleaning reduced the CaO to below 1%, but the recovery was lower.

In comparing the results of this mill run with the results obtained in the small-scale tests, it must be remembered that wet-ground material was used in the small tests, whereas dry-ground material was used in the mill run. Dry grinding undoubtedly changed the flotation characteristics of the dolomite particles because of the smearing action. As was expected, this produced a talc product of higher lime content.

No attempt was made to obtain the maximum recovery of talc in the rougher concentrate or to increase the recovery of steatite-grade talc in the final concentrate by retreating the middlings.

A chemical analysis of the talc concentrate from the preceding mill run is given as follows:

	(%)
Total CaO	1.76 (HCl-soluble CaO, 1.51)
FeO	0.10
Fe_2O_3	0.29
Al_2O_3	0.23
CO_2	2.45
MgO	32.20
SiO_2	57.78
H_2O at 105°C.	5.20
	100.01

Upon examination under the petrographic microscope, the beneficiated product was found to be composed essentially of talc with residual carbonates (dolomite and calcite). Little tremolite or other impurities were detected. A considerable portion of the talc was present in the form of fine micaceous flakes. In other commercial talcs examined, most of the talc grains exhibited characteristic bladed and fibrous forms or aggregates of such individuals.

VI. Ceramic Properties

Beneficiated talc of the preceding analysis was tested by incorporating it in the following body formula: talc 90, potash feldspar 5, and plastic kaolin 5%. Yellow potato dextrin was used as a binder, and test pieces were prepared by pressing at 3500 lb. per sq. in. with a moisture content of 5%. The same body was prepared in an identical manner using California talc with a reported analysis as follows:

	(%)
Total CaO	0.60 (soluble lime 0.50)
Fe_2O_3	0.94
Al_2O_3	2.58
MgO	31.20
SiO_2	58.80
Ignition loss	5.40

The test pieces were fired to several different temperatures, and the following significant observations were made during the course of the tests:

(1) The body prepared from beneficiated Madoc talc presented no difficulties in pressing and showed no signs of being abrasive.

(2) After firing, bodies containing Madoc talc exhibited a pure white color much whiter than the bodies containing the California talc.

(3) The body prepared with Madoc talc required a higher firing temperature to reach vitrification than the body prepared from California talc.

Subsequent tests on dielectric properties of bodies prepared from beneficiated Madoc talc and the same bodies made with California talc indicated that when an equal degree of vitrification was attained the dielectric properties were similar.

A sample of this Madoc talc was submitted to the Tuscaloosa, Alabama, station of the United States Bureau of Mines, where, through the kindness of T. A. Klinefelter, senior mineral technologist, tests were carried out on it.

Here also it was found that the talc was nonabrasive, it fired to a pure white color, and it was more refractory than the California talc with which it was compared.

Samples of the beneficiated Madoc talc were also submitted to several manufacturers of steatite electrical insulators in the United States for testing.

VII. Summary

Beneficiated Madoc talc is soft and nonabrasive, it fires to a pure white color, and it has a low content of iron oxide and alumina.

The beneficiated dry-ground Madoc talc produced by ordinary flotation methods offers interesting possibilities for use in the steatite electrical insulator industry, especially as a blending material with other talcs of lower refractoriness.

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CASTING SLIP CONTROL*

BY ARTHUR S. WATTS

The control of casting slips is one of the most intriguing of all ceramic operations. Its relation to plasticity of clays is obvious, but until we have more definite knowledge of the causes of plasticity and can evaluate this property in a precise manner we can hardly hope to attack successfully the casting slip problem.

Every ceramic engineer recognizes three factors in plasticity of clays, viz., (1) grain size, (2) organic material present, and (3) amount and nature of soluble salts present. As ball clays possess the smallest grain size, the largest content of organic material, and the highest content of soluble salts, it is natural that they are the most plastic clays, but the relative influence of these three properties on their properties in casting slips is still unknown.

If we consider grain size separately, we find interest in the following analysis:

GENERAL AVERAGES OF GRAIN SIZE OF CLAYS (%)

	$< 5\,\mu$	$< 1\,\mu$	$< 0.5\,\mu$	$< 0.2\,\mu$
American medium ball clay	99	70	45	15
English medium ball clay	97	75	60	20
Fla. kaolin washed	75	50	35	15
S. C. kaolin washed	65	30	15	5
Ga. kaolin washed	65	30	10	3
Ga. kaolin crude	60	25	10	2
N. C. kaolin refined	60	25	15	4
English china clay washed	60	25	10	2
N. C. kaolin washed	40	20	10	2
English china clay (coarse) washed	45	20	8	0

The estimated order of plasticity of everyone familiar with clays would be similar to the rating in this table, but in casting slips we must consider gelling, which is apparently related as much to organic material as to grain size.

Gelation of clays is apparently closely related to thixotropy, which is characterized by a gel form when not agitated but assumes sol characteristics when agitated. This change is reversible an indefinite number of times at a constant temperature, provided no evaporation of liquid occurs.

This gelation tendency is much more apparent in the ball clays, and its objectionable properties are apparently the chief source of casting slip troubles. A careful study of ball clays in dilute suspensions reveals a wide difference in the character of the organic matter present. In some ball clays high in vegetable matter we find many woody tissues and relatively little of the oily form of organic matter, whereas we find the reverse in other ball clays of similar raw color and behavior in plastic mixtures.

The writer's studies of ball clays indicate that high dry strength is usually related to either form of organic material, but the tendency to abrupt shrinkage and warpage in drying is related to the oily form of organic material rather than to the fibrous or lignitic form when the body is molded in the plastic state. When employed in slip form, however, the oily form of organic matter responds to electrolyte control, whereas the fibrous form promotes thixotropy, possibly owing to the water absorbed.

As a means of differentiation between the ball clays on the basis of organic matter present in its different forms, the following procedure is suggested:

To 1000 cc. of distilled or rain water at 150–160°F. add 100 gm. of ball clay and digest in a covered vessel for 1 hr., replacing evaporation by water of the same temperature and stirring thoroughly at frequent intervals. After 1 hr., mix thoroughly and pour into a glass vessel and observe settling. The coarse material and sand will settle first, followed by the major portion of the clay, whereas both the oily and fibrous material will remain suspended. Pour the water off and screen through a 300-mesh sieve. The fibrous material and most of the oily organic material will remain on the lawn. Then wash the screen into a separate vessel with water heated to boiling, and the residue will be practically all fibrous material. Remove the material from the screen, evaporate to dryness, weigh, ignite in a crucible slowly over a Bunsen burner until no carbon remains, and reweigh.

Test the material which passed the 300-mesh sieve in the same manner.

The ash in both cases is practically pure clay, and the original combined water may be calculated. The remainder of the ignition losses are fibrous organic material and oily organic material.

This procedure has been valuable in evaluating ball clays for ceramic uses.

It has been suggested that the oily form of organic material would be lost in a filter-pressed body, but the writer finds that little escapes unless the slip is pumped into the filter press at a temperature of at least 120°F., which practice is neither common nor practicable.

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (White Wares Division). Received April 20, 1943.

DEPARTMENT OF CERAMIC ENGINEERING
OHIO STATE UNIVERSITY
COLUMBUS, OHIO

A GLASS FOUNDATION*

By Alexander Silverman†

The glass industry has grown from its small beginning in Jamestown, Virginia, in the early part of the seventeenth century, to a five hundred million dollar American glass industry in which about two hundred manufacturers participate.[1] The appreciable application of scientific control to the industry began with the twentieth century. For almost three centuries, glassmaking in America depended on the transmission of its secrets from one individual to another.

The scientific control which began with the present century has wrought wonders. It has placed America in the forefront in the production of glass. The food industry, like the glass industry, started with recipes for manufacturing processes that were usually individual secrets. They were handed down from generation to generation. Routine chemical analysis was gradually introduced as in the glass industry, and later more extensive research produced new and better products. When Howard J. Heinz II, President of the H. J. Heinz Company of Pittsburgh, on February 18 addressed the Pittsburgh Section of the American Chemical Society, he remarked, "Today it is realized that research is not optional, but is imperative for the survival of business. In our own Company we are spending twice as much as in 1929 for research and quality control, but despite expanded activity in this field, there is a practical limit to the research program of an industrial company."

You cannot open a scientific journal or an illustrated popular magazine without seeing glass portrayed or implied in the majority of illustrations. Practically all of the illustrations depend on the glass lenses of the camera for photographing before the cuts are prepared. In Mr. Heinz's address he further commented, "Food manufacturers cannot afford abstract study which might be of importance to mankind but which would have doubtful application to the industry for a long period of time. While some fundamental research is being carried on by industry, it is recognized that such research is not being conducted on a sufficiently important scale." Like the food industry, the glass industry is conducting fundamental research but not on a sufficiently extensive scale to provide some of the information which is necessary for the industry and for the people at large.

In addition to well-equipped company laboratories, there are technical and trade associations, some of which operate laboratories. The interests of these are limited. There is a research institute. There are a few subsidized research fellowships. These have special purposes. There is no organization which thinks of the glass industry as a whole and which also thinks of the American people who use its products.

From time to time, through large grants from the living or bequests from the dead, researches have been endowed in educational and research institutions. To the writer's knowledge, no such grant for the study of glass has ever been made in America. Although wealthy glass manufacturers may have left bequests for other purposes, these have not provided for general scientific investigation. Governmental trends and the political temper of the day make it unlikely that the future will permit individuals to accumulate great fortunes with which to endow research. Besides, the return from endowments and investments, generally, is diminishing to a point where these funds prove to be inadequate. To provide for adequate pure scientific research will therefore require funds of which the principal can be utilized instead of the income. Individuals who still have large fortunes realize this. In England, Lord Nuffield, at first a producer of bicycles and later of automobiles, has given his fortune of ten million pounds for the establishment of a foundation where parts of the principal are used from year to year. The dwindling of individual fortunes and the limits which are placed on income make it extremely unlikely that vast fortunes will again accumulate. It may not be possible or desirable for the Federal Government to provide the funds. The responsibility will devolve upon industry, where cooperative plans will become necessary to provide for general purposes concerning which no individual company will undertake an investigation. We have entered an era of foundations. Their aggregate capital already exceeds one billion dollars. It would seem timely that a glass foundation be established.

Such a foundation should (1) operate by lawful and effective means as a public institution on a nonprofit basis; (2) further develop and apply the science of glassmaking; and (3) be dedicated to the improvement of glass and its products in the interests of the public as well as the industry.

To establish a glass foundation, manufacturers could cooperate through fixed annual subscriptions. There might be classes of members, e.g., (*a*) those paying a fairly large amount ($5000 to $10,000) each year and (*b*) those paying a somewhat smaller sum per annum. A fixed total, payable in annual installments, should be available for a period of at least five years, and the members of the foundation should each year pledge themselves for an additional year beyond the five-year period. In an existing foundation which follows this plan, a small portion of the principal is used to pay the salaries of a science director and several paid officers and to provide suitable quarters for the organization. The major portion furnishes research grants to educational and research institutions. By subsidizing researches of graduate students and fellows in colleges and universities, it also serves another important purpose, namely, the training of scientific personnel for the industry.

To insure independence and quality in the government of a glass foundation, there should be, in addition to representation from industry, an advisory group selected from the sciences.

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* A luncheon address presented before the Glass Division at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943. Received April 26, 1943.

† Head of the Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa.

[1] See also "Glass After the War" by Alexander Silverman, pp. 217–22, July, 1943, *Bulletin*.

Advertising, by manufacturers, of their membership in the foundation, or of results obtained by the foundation, should be prohibited.

Were a glass foundation available today, it could serve not merely for pure research and exploration and for training scientific personnel, but also as a clearing house on glass in the war emergency. It might even expedite research for which there is an immediate war demand.

A glass foundation should not establish its own central research laboratory, for there might be a tendency in such quarters especially to favor certain interests. It would be more economical and probably much better to establish centers for pure and applied research from coast to coast in already existing educational and research institutions.

Careful consideration should be given to the possibility of establishing a glass foundation, with the idea of getting it under way promptly. Early activity should prove helpful to the industry, to the people, and last, and at the moment the most important, to the Government of the United States of America in the war emergency.

NEW PROJECTS AT THE ENGINEERING EXPERIMENT STATION, OHIO STATE UNIVERSITY

Ceramic Space Heaters

An interesting project started recently at the Engineering Experiment Station is the development of ceramic space heaters sponsored by the War Production Board. This, of course, is one of the many ceramic projects designed to relieve metal for strategic purposes. The space heaters are being developed for government housing projects, but general use likely will be found for them. A stove of ceramic materials in ceramic colors can be attractive. Especially decorative are ceramic radiators or convectors which transfer heat from the stove to adjoining rooms.

DeWitt Wyatt, heating and ventilating engineer, is developing this stove. Mr. Wyatt has been a consulting engineer in Columbus, Ohio, for many years; he also has been employed by the Delco Light Company, the Frigidaire Corporation, the Ebinger Sanitary Manufacturing Company, and the Kelvinator Company. He supervised the heating and ventilating installation at Fort Knox, Ky., just before undertaking work on the space heater.

During the first World War, Mr. Wyatt was research engineer for the Sewer Pipe Association, and, in relation to his work of developing ceramic pipe to relieve metal for strategic purposes, coined the expression, "Don't bury metal except in enemy skulls."

Ceramic Pressure Pipe

In this second World War, also, an endeavor is being made to bury in the earth as little metal as possible. The first consideration of the newly organized National Clay Pipe Research Corporation, composed of twenty pipe manufacturers located over the country from the Pacific to the Atlantic, is the development of a ceramic pressure pipe for pipe-line systems for the transfer of oil and oil products, chemical liquids, etc.

This development work is being carried on at the Station with Earle T. Montgomery as senior research engineer. Mr. Montgomery's experience has been in industrial, university, and government work. In industry he has been associated with the Wirt Manufacturing Company, the Champion Spark Plug Company, and Smith and Stone, Ltd. He owns the Montgomery Porcelain Products Co., Franklin, Ohio. Mr. Montgomery has been on the faculty of the University of Illinois and the New York State College of Ceramics. At the last named, in addition to professorial duties, he was Assistant Director. In government work, he has been with the National Bureau of Standards, and for a year previous to last April 1 he was with the War Production Board as Senior Industrial Specialist, Miscellaneous Minerals Division.

New Methods for Cellulated Clay Manufacture

Harry J. Knollman, until recently with the Edward Orton, Jr., Ceramic Foundation, is now engaged in research work at the Engineering Experiment Station on a cooperative project with Cinder Block, Inc., Roanoke, Va. This Company manufactures preshrunk lightweight concrete cinder blocks. Mr. Knollman a ceramic engineer graduated from Ohio State University, will work on the development of a lightweight aggregate for the cooperator.

Mr. Knollman's experience has been in the ceramic and economic fields. In the past, he has been engaged chiefly in the abrasive and superrefractories fields, having been with such companies as the Abrasive Company and the Vitrefrax Corporation. More recently, he has served as an economist on the West Coast.

New Ceramic Products

Crawford Massey, another Ohio State graduate, is employed in developing new products for the Mosaic Tile Co., Zanesville, Ohio. Mr. Massey was a ceramic engineer for this Company before making his headquarters at the Engineering Experiment Station as research associate on the Company's cooperative project at the Station. Mr. Massey has also been associated with the American Encaustic Tiling Company, Gladding, McBean & Company, and the General Tile Corporation.

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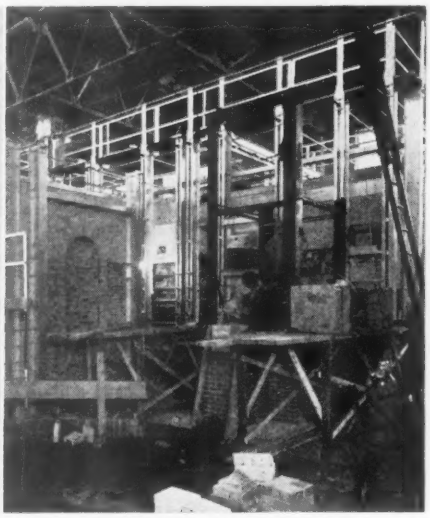

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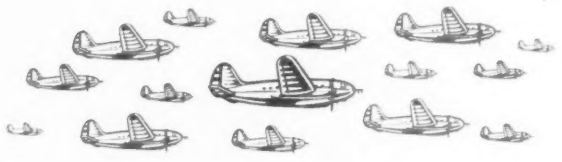

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Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Combustion Control
Leeds & Northrup Co

Combustion Meters (CO_2 Recorders)
Leeds & Northrup Co

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton Jr., Ceramic Foundation

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Norton Co.
Potters Supply Co

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Cutters: Diamond impregnated wheel type
Felker Mfg. Co.

Decorating Supplies
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradient*)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Leeds & Northrup Co

Gauges, Pressure
Leeds & Northrup Co

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co
The Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co
The Vitro Mfg. Co.

Glaze Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
The Hommel, O., Co., Inc.

Gold
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.

Iron Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.

Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.

Minerals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Mixers
Clearfield Machine Co.
National Engineering Co.

Mixers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.

Mullers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Opacifiers
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Oxides
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Pans—Wet and Dry
Clearfield Machine Co.

Pins
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Placing Sand
Great Lakes Foundry Sand Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
The Hommel, O., Co., Inc.

Pyrometer Tubes
Carborundum Co.
Leeds & Northrup Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Leeds & Northrup Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Recorders, CO_2
Leeds & Northrup Co.

Recorders, Draft
Leeds & Northrup Co.

Recorders, Tank Pressure
Leeds & Northrup Co.

Refractometers
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.

Refractories
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Titanium Alloy & Mfg. Co.

Respirators
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.

Rutile
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinders and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel, O., Co., Inc.

Saws: Diamond impregnated for cutting off
Felker Mfg. Co.

Screening and Magnetic Separators
National Engineering Co.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Selenium
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel O., Co., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
The Hommel, O., Co., Inc.

Silicate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Spray Booths
The Hommel, O., Co., Inc.

Spraying Equipment
The Hommel, O., Co., Inc.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Sulfur
Stauffer Chemical Co.

Sulfuric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.

Talc
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Cohart Refractories Co.

Tanks (Pickle)
The Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp.
Norton Co.

Tin Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Drakenfeld, B. F. & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel, O., Co., Inc.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
Foote Mineral Co.

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